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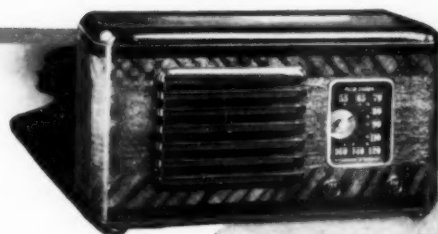
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METAL INDUSTRY

VOL. 38, NO. 4

FABRICATION · ASSEMBLING · PLATING · FINISHING

APRIL, 1940

Sharing Responsibility

Leaders or foremen in industry may be of two types; namely, those who tend to every last detail in the management of their department, and those who believe in placing responsibility on their subordinates.

Let us consider the first type of foreman who, for example, may be in charge of a plating department. He may not believe in letting anyone else make additions to the plating solutions, either believing his subordinates incapable of properly doing this work, or thinking that if his workmen knew how to manage the solutions, they might steal his job.

He may insist on analyzing his solutions himself even when laboratory service is available, to indicate self sufficiency. He may concern himself with all details regarding time cards, routing, and routine cost calculations when such work can be readily done by clerks.

In short, this type of foreman is always rushed and never has time to finish his work. Of course, in small shops particularly and even in large shops, there is more or less routine work which must be done, but time spent on this type of work may be lessened by proper sub-division of responsibility.

In the last analysis, a foreman is judged by the quality of work emanating from his department and how efficiently or cheaply this work is done. If material or labor costs are high from poor control of solutions or operations, or from poor equipment, the statement that the foreman was too busy to check solutions or take care of cleaning or plating problems, is only regarded as an alibi.

A "one-man" shop may operate satisfactorily while the foreman is on the job, but what happens when he is sick or wishes to take a vacation? The department may be like an automobile with a few

sparkplugs missing. The management may soon regard this as an unhealthy condition.

A short time ago, the editor visited a plating foreman in Connecticut who had just been ill for two years and was forced to be away from his work for protracted periods. Nevertheless, his plating department operated smoothly with a minimum of supervision. On being asked how this was possible, he said—"I have spent over 30 years in the plating business and have had charge of men since I was 16 years old. I have always taken the viewpoint that every human being craves some measure of responsibility. I have impressed upon each man in my plating room that he is responsible for the solutions which he is using. Naturally, it took some time to acquaint each man with the fundamentals regarding the solutions which he operates. Noon hour talks and after hours instruction were necessary. Now some of the men know more about the solutions they are using than I do. The important point being that they operate smoothly and efficiently without my attention." This man represents the second type of foremen mentioned above.

Trying to run the whole show is a common fault of men in many types of executive positions. One factory manager in charge of a large hardware company some time ago tried to be the chief engineer, personnel director, sales manager et cetera with the inevitable result that blunders were made and an important engineering error resulted in the loss of his job. He had capable engineers for proper advice but he preferred to be the boss and make all the decisions. He had his finger on everything but things didn't run smoothly.

Selecting of proper employees and the bestowing of a share of responsibility upon them even if small has paid and will pay dividends.

An Investigation of Electrodeposited Gold Alloys¹

By Dr. C. B. F. Young² and V. E. Herschlag³

The authors have investigated the effects of agitation, current density, temperature and pH on the composition of gold alloys deposited upon a rotating cathode. The bath contained gold with a lesser concentration of silver and a greater concentration of copper and nickel.—Ed.

Gold is still the leading metal for the jewelry line. During the last few years "English Gold," which is nothing more than 24 karat metal, has been the leader in this particular field. There are several objections to using the straight metal, however, due to its softness and expensiveness. The former causes the coating to wear away entirely too fast, while the latter increases the cost of the article. The natural tendency, therefore, is to alloy the element with base metals such as nickel, copper, silver, cadmium, zinc, tin, etc. This is also true in the rolled gold field where a gold alloy is fused onto base metal and the whole rolled into thin sheets. Each method has its good points and this paper will not discuss them to any extent. However, one advantage of the electrodeposited coating will be pointed out and that concerns the so-called "raw edges." These are produced during the stamping operation and are caused by the die shearing off the metal and exposing the foundation material. This is generally taken care of by flashing for color after the article has been finished. This does not offer the best protection against corrosion. The above is not true in the case of electrodeposits because the gold is applied after the object

has been stamped. Thus, all exposed areas are covered with approximately the same thickness of gold alloy.

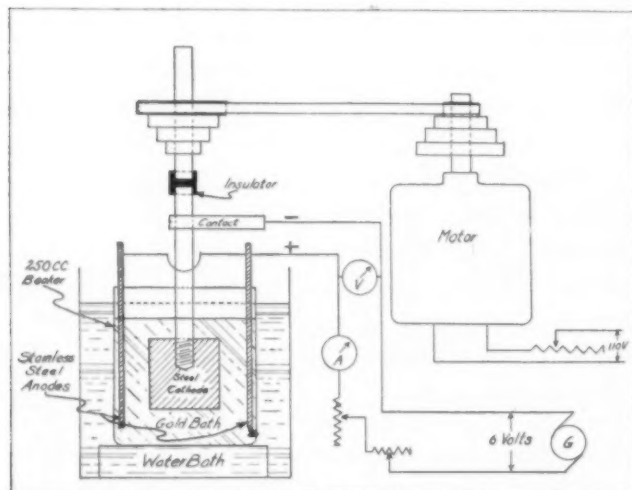
The question naturally arises as to the gold alloy being deposited. Gold alloy plating is a very old practice. However, there is very little published on this specific field. It has been the experience of one of the authors to ask different men in the industry the same questions and to receive different answers. On investigating further into the field, it was found that no definite planned research had ever been pursued in regard to this interesting subject. Later, it was decided to investigate gold alloys, using as a basis, the revolving cathode which has been used in work by the senior author on cadmium-zinc⁴ and nickel-cobalt^{5,6} systems.

Equipment Used

The apparatus consists of a cathode mounted on a shaft on which is located a set of pulleys. These are connected by a belt to a motor and by changing the belt, different speeds of the shaft can be obtained. To the shaft is attached a cathode which is one inch high and one inch in diameter. This can be detached from the shaft by unscrewing the two. Figure I shows the apparatus and attached cathode.

The bath in which the cathode was inserted was held in a 250 cc beaker. Each bath was taken from a quantity made up in advance and one batch of 225 cc was used only once. After that it was discarded and a new solution was obtained. This was done so that the solution at all times would be as nearly uniform as possible. In all cases, insoluble anodes were used. The bath contained:

	gms./liter
Gold	1.43
Silver	0.20
Copper	12.00
Nickel	7.00
Free cyanide—KCN	12.80



Apparatus Used For Experiments
Fig. 1.

1. This paper was delivered before a joint meeting of the Providence-Attleboro branch of the American Electroplaters' Society and the New England Jewelers & Silversmith Manufacturing Association on December 18, 1939 by Dr. Young.
2. Head, Institute of Electrochemistry & Metallurgy, New York City.
3. Research Fellow, Institute of Electrochemistry & Metallurgy, New York City.
4. "Cadmium Zinc Alloy Plating from Acid Sulfate Solutions", C. G. Fink and C. B. F. Young, Trans. Electrochem. Soc., **63**, April (1935).
5. "Nickel Cobalt Alloy Plating from Acid Sulfate Solution", C. B. F. Young and N. A. Gould, Trans. Electrochem. Soc., **66**, pp. 585-597, April (1936).
6. "Nickel Cobalt Alloy Plating from Low pH Acid Sulfate Solutions", C. B. F. Young and Charles Egerman, Trans. Electrochem. Soc., **72**, pp. 447-460, October (1937).

A definite set of conditions were selected for each run. Next, 225 cc of solution were placed in the flask. A cathode was buffed, cleaned, weighed and attached to the shaft and then inserted into the bath which had been adjusted to the correct pH and temperature. The anode was placed in position and the current density adjusted. After running for a predetermined time, the current was broken and the cathode removed, dried and weighed. The steel cathode with its gold alloy plate was then placed in a solution containing potassium cyanide and hydrogen peroxide which dissolved the coating without greatly affecting the steel cathode. The resulting solution was analyzed for the various metallic ions and the iron cathodes were again used to obtain other deposits.

By using the above set-up, it was possible to vary the current density, temperature, pH and agitation, and by analyzing the resulting deposits, a record could be obtained which would show the direct effect of each variable upon the composition of the alloy. At this point it might be well to indicate that emphasis was placed on the effect of the different variables upon the composition of the alloy and not upon the physical aspects of the deposit such as appearance, ductility, adherence, ability to buff, etc. However, in all cases the plates obtained adhered to the cathode and were typical cyanide gold deposits. No effort was made to buff and polish the plates obtained.

By referring to the graphs, Figures II to V, it will be seen that in all cases the per cent of the alloy is represented by the abscissa while the ordinate can be either the current density, pH, temperature or agitation used in a given group of experiments. Each of these graphs will be discussed separately.

Discussion of Results

The first graph, Figure II shows the relationship between the percentage composition of the alloy and agitation. This set of curves was obtained by plotting runs Nos. 2, 3, and 5 given in Table I. The agitation here, as well as in all runs recorded in the paper, was accomplished by rotating the cathode at a definite number of revolutions per minute. Thus zero R.P.M. means that the cathode was not rotated, and 50 R.P.M. indicates that the cathode was turned 50 revolutions per minute. It must be borne in mind, however, that a definite amount of agitation was obtained by the gassing of the cathode due to the hydrogen being liberated which is characteristic of most cyanide baths. This agitation was not taken into consideration in drawing the curves in Figure II.

From a glance at the curves, it can be seen that as the stirring is increased, the amount of gold in the alloy definitely increases. The same is true of copper to a slight degree. On the other hand, the amount of silver in the alloy decreases. Nickel has a slight tendency to decrease also. Therefore, it can be said, when using a solution of the composition given above and the conditions as specified in Table I, that as agitation is increased, a higher karat alloy is obtained which is also higher in copper and lower in silver. Thus, the alloy has a tendency to become redder as agitation is increased.

The next variable studied was current density. It will be seen by looking at Figure III that a tremendous change occurs in regard to alloy composition when the current density is varied. Gold has a slight tendency to decrease although this is small. Nickel shows this same

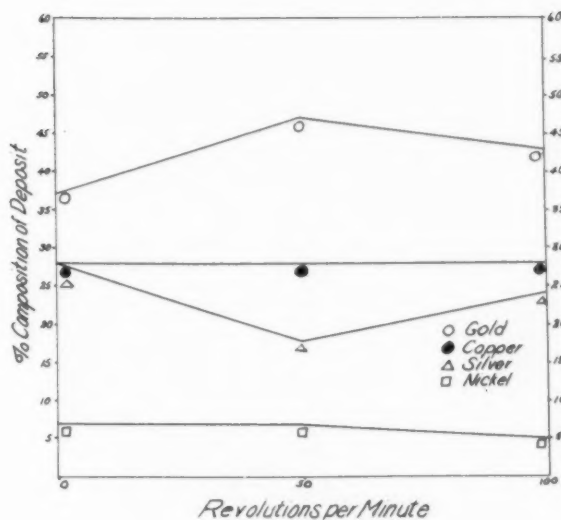


Fig. 2.

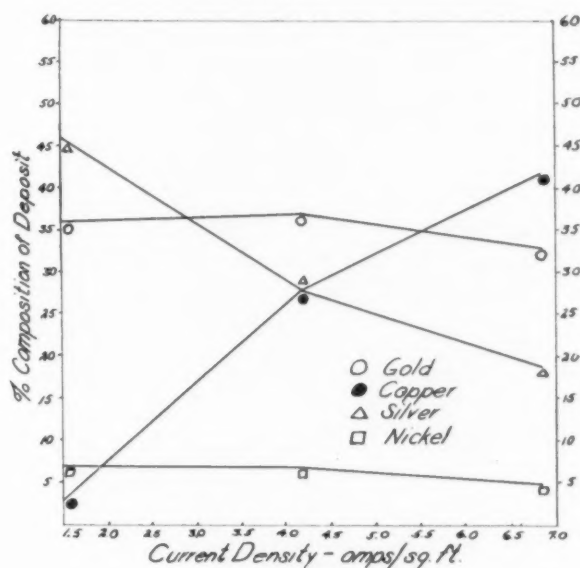


Fig. 3.

characteristic. However, there is a large change in the amount of copper and silver present. As the current density is increased, the amount of copper increases very markedly while that of silver decreases almost proportionately. Thus, it will be noted that copper increases from 3% to 42%, a gain of 39%, while silver decreases from 46% to 19%, a decrease of 25%. The current density was varied from 1.5 amps./sq. ft. to 6.8 amps./sq. ft. The curves in this figure were obtained by plotting the data given in Table I, runs No. 1, 2 and 4.

The relationship of alloy composition to temperature was next investigated. Figure IV was obtained by plotting the data from Table I, Nos. 1, 6 and 7. Copper and nickel show little change. True, copper has a tendency to increase and nickel to decrease as the temperature is raised. However, this is nothing compared to the variations of the percentages of gold and silver as the temperature is raised. It will be noted that as the temperature changes from 22° to 44° to 60° C., the gold increases from 36% to 59% and then decreases to 37%. Silver, on the other hand, does just the opposite. As the temperature is raised, silver decreases from 46% to 25% and then increases to 49%.

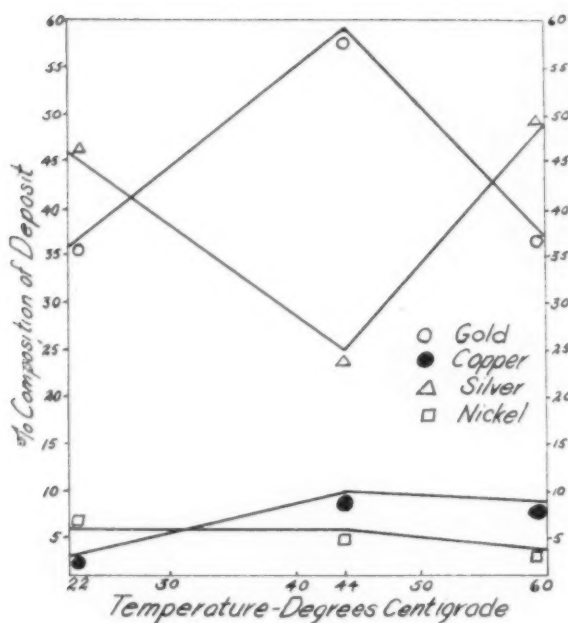


Fig. 4.

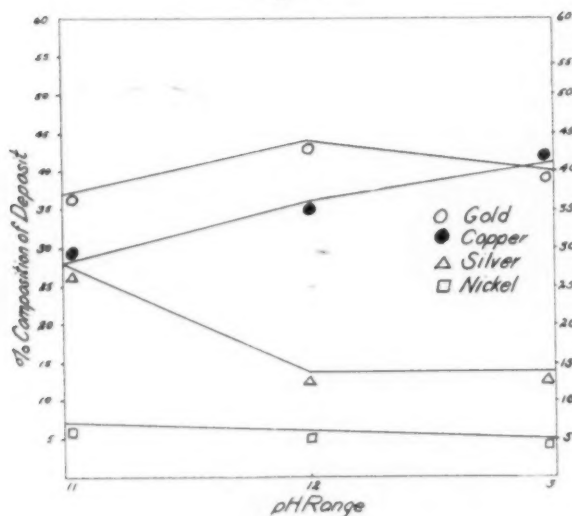


Fig. 5.

When the above data were obtained, it was thought that there was some mistake. On checking back, no error whatsoever was found. Later on checking with several practical gold platers who are very familiar with gold alloys it was found that all agreed on such a behavior. Only a few days ago on investigating another gold series which contained no silver, a similar condition was found to exist. The author feels sure that for the conditions imposed, the curves for silver and gold are correct.

Thus, it may be said that as the temperature is increased from 22° to 60° C. the karat of the deposit increases at first and then decreases. Perhaps this peculiar reaction may be due to the varying rate of change of stability of complex cyanides with change in temperature.

In Figure V, it can be seen that as the pH was varied the composition of the coating was different. There is very little effect upon the nickel content. However, the gold content of the alloy increases from 3 to 6% while the content of copper increases up to 13%. These increases are balanced by a sharp decline in the per cent silver in the alloy. This figure was obtained by plotting runs Nos. 2, 8 and 9 in Table I.

TABLE I

Percentage Composition of Alloy					Conditions of Run						
Run No.	Au	Cu	Ag	Ni	pH	R.P.M.	Temp. °C.	C.D. amps. sq. ft.	Voltage Drop	Ampl. Material Dep. (grams)	Per Cent Cathode Efficiency
1	36	3	46	7	11.3	0	60	1.5	1.7	0.080	57
2	37	28	28	7	11.3	0	60	4.2	1.8	0.15	60
3	47	28	18	7	11.3	50	60	4.2	1.8	0.26	94
4	33	42	19	6	11.3	0	60	6.8	2.0	0.13	56
5	43	28	24	5	11.3	100	60	4.2	1.9	0.29	100
6	59	10	25	6	11.3	0	44	1.5	1.8	0.11	55
7	37	9	49	4	11.3	0	22	1.5	1.9	0.07	36
8	44	36	14	6	12.0	0	60	4.2	1.9	0.17	66
9	40	41	14	5	13.0	0	60	4.2	2.0	0.16	65

Conclusion and Summary

In conclusion, it may be said that a change in the current density, agitation, pH and temperature all affect the composition of gold plated alloys. It must be pointed out that the above conclusions and the following summary hold only for the conditions imposed upon these experiments. Also it must be said that the present paper is not a complete treatise on the subject. For instance, only one set of conditions was used in obtaining the curves on the change of the alloy with pH. With this variable alone, the temperature, current density and agitation could be varied to obtain a family of curves. It can readily be seen that this work is only an introduction to the field.

Summarizing it may be said that:

An increase in agitation:

1. Increases gold,
2. Decreases silver,
3. Has no effect on remaining metals.

An increase of temperature:

1. Increases and then decreases gold,
2. Decreases and then increases silver,
3. Increases copper,
4. Decreases nickel.

An increase of current density:

1. Slightly decreases gold,
2. Increases silver,
3. Increases copper,
4. Does not affect nickel.

An increase in pH:

1. Increases gold,
2. Increases copper,
3. Decreases silver,
4. Has very little effect upon nickel.

The authors would like to thank Mr. Albert M. Pfomm, a trustee of the Institute of Electrochemistry and Metallurgy who aided materially with the laboratory work and drawings. Our appreciation also goes to Mr. Garth Putnam of Columbia University who consented to do the analytical work, and last the complete work was made possible by the generous financial contribution of Mr. Benjamin Robinson of A. Robinson and Sons, manufacturers of assayed gold plating solutions.

All work was done at the laboratories of the Institute of Electrochemistry & Metallurgy, New York City, as its service to the progress of the electroplating industry.

Automatic Bright Nickel Plating

of Automobile Radiator Grilles

By A. G. Spencer

Metallurgist,
Chevrolet Motor Co., Flint, Mich.

The author describes what is believed to be the world's largest bright nickel plating tank. Methods of polishing, cleaning, and plating sequences are outlined.—Ed.

It is said that it is hardest to save the first thousand dollars and that succeeding thousands come more easily. Those who have had the experience also report that it is as simple to think and deal in terms of millions as it is in hundreds—the only difference is a few digits. The same is true, with a few reservations, in operating a large nickel tank instead of a small one—it is a matter of larger tanks, more plating salts and anodes, larger generators—in fact, more of everything that goes with plating. With basic operating principles and practices the same, the most noticeable difference is that, with the greater quantity of work in the tanks, when anything goes wrong, the number of rejected pieces increases much more quickly. For this reason, constant control is necessary to see that everything is functioning properly and that troubles are corrected as soon as found.

In the Sheet Metal Plant of the Chevrolet Motor Co., Division of General Motors Corporation, at Flint, Michigan, pressed steel radiator grilles for passenger cars are plated in a return-type full automatic plating machine,

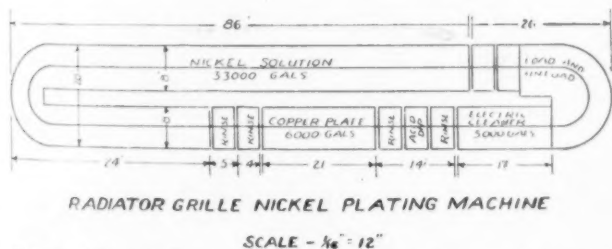


Fig. 1. Sketch plan of plating tanks of automatic copper and nickel plating machine.

with a nickel tank capacity of 33,000 gallons, using a commercial bright nickel plating solution. Today, this is said to be the largest bright nickel tank in the world.

Like Topsy in "Uncle Tom's Cabin", this plating tank "jest grewed" from a smaller one of 10,000 gallons capacity. It did this in several successive stages to meet



A. G. Spencer

changes in design of the grille and increased production demands. Experience gained this way in small doses, gave added confidence in the probable success of each increase and indicated changes or improvements that would be of benefit in the larger unit.

Plate No. 1 shows sketch plan of the plating tanks of the copper and nickel plating machine with dimensions and tank capacities.

Plate No. 2 shows the loading and unloading end of the machine, also, the method of racking the grilles on saddle carriers on a conveyor chain running along a central channel rail through the middle of the tanks. Scrubbing tanks for soaking and hand scrubbing before racking are at the right.

Plate No. 3 from the opposite end of the machine gives an idea of the size of the bright nickel tank with empty carriers riding on cathode bus bars and bagged nickel anodes on anode bus bars underneath the cathode bus and at the sides of the "J" shaped tank. Hinged ventilating ducts show along the sides over the anode bus bars. Cathode main bus bars are connected at the ends of the tank to the tapering tank bus bar and are not shown. The tank bus bars are split half way along the tank; one half being connected to each generator. Two of the eight main anode bus bars are shown in the foreground at right and center. Rubber covered anode mains lead from these to the central anode bus across the bottom of the tank.

General Details

This machine is one of five full automatic return-type plating machines used in plating radiator grilles for assembly in Chevrolet passenger cars and trucks of this year's models. They are separated from the polishing and buffing departments by glass and steel partitions to keep out the dust and lint. More fresh heated air is drawn in from outside the building by several ventilating fans than is pulled out by the tank ventilation. All floors are of acid proof brick with open drains in the floor leading to plant sewers.

Due to lack of floor space, all generator sets and panels are in penthouses above the roof and all filter presses and tank heaters are above the tanks under the roof. Two steel storage tanks, one of 15,000 gallons and one of 20,000 gallons capacity for storing nickel solutions when tank cleaning is necessary, are outside the building.

The size of the installation may be pictured if the reader considers the amount of chemicals and amperes of current required for the complete plating operations of electric cleaning, copper strike, and nickel plating:—

Number of generators	4
Capacity in amperes	36,000
	(most of it at 12 volts)

To fill the tanks requires:

Metal cleaner	2,400 lbs.
Muriatic acid	500 gallons

Sodium cyanide	2,500 lbs.
Copper cyanide	1,540 "
Nickel sulphate	143,000 "
Nickel chloride	16,500 "
Boric acid	10,300 "
Addition agents	580 gallons
Copper anodes	5,000 lbs.
Nickel anodes	90,000 "
Current density in nickel	70 amps./sq. ft.
Time to deposit 0.001" nickel ...	25 minutes

Since the quality of any plated deposit is governed by the quality of the base metal and greatly affected by the forming and polishing operations before the work enters the plating tanks, it may be of interest to describe these factors as briefly as possible.

Base Metal:

The steel grilles are blanked and formed from single sheets of deep-drawing stock of a quality that will stand the drawing operations without showing cracks, stretcher strains, or orange peel. They are rolled at the mill to a hardness of Rockwell B 40 to B 45 with a smooth satin finish and are coated with a proprietary anti-rust oil containing a wetting agent which permits easy cleaning. They are tied in bundles with steel ties and wrapped in waterproof paper to prevent rusting and scratching in shipping.

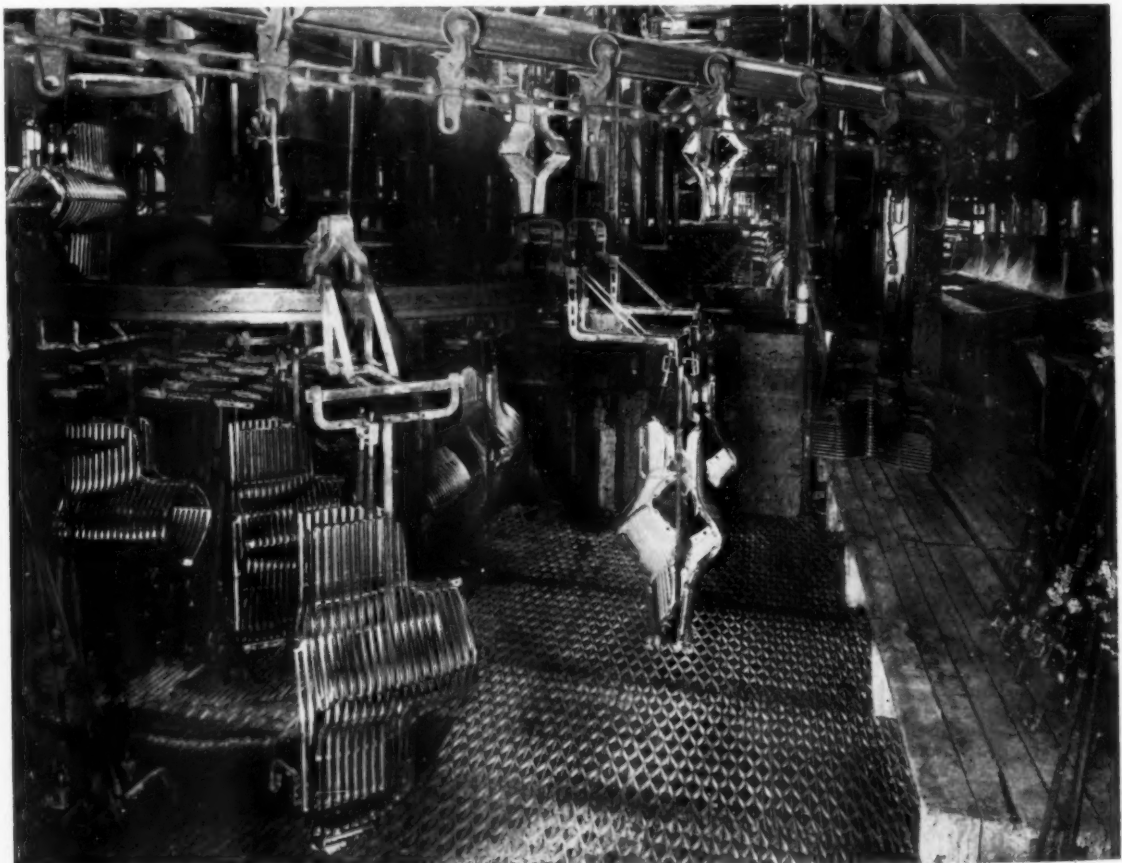


Fig. 2. Loading and unloading end of plating machine. Shows the method of racking grilles on saddle carriers on a conveyor chain running along a central channel rail through the middle of the tanks.

Blanking and Forming:

To reduce stretcher strains, all sheets are passed through a roller leveler machine of the type which bends the sheet equally from both sides. The lubricant is the proprietary oil mentioned in the preceding paragraph. This operation is performed just before blanking, as stretcher strains will re-appear if any great time elapses between levelling and blanking.

Blanking, lancing, and forming are done in a series of presses and the operations, while very interesting mechanically, are outside the scope of this article. One point of interest to the plater is that the drawing compounds are carefully supervised to prevent the use of any material which would be difficult to remove before plating. Wherever possible, soft soap is used instead of paste compounds. Free sulphur is prohibited, since it will form alkali sulphides with the metal cleaners and sulphide films on the base metal. While iron sulphide is insoluble in alkalies and will pass through the electrolytic cleaner, it is soluble in acids and will be removed in the muriatic acid dip tank. But where work has to be replated without first removing all the old deposit, the case is vastly different. Copper and nickel sulphides from the contaminated cleaner are insoluble in alkalies and acids, so will remain on the pieces and will prevent adherence of subsequent deposits.

Polishing:

An automatic polishing machine of the return con-

veyor type is used with supporting ribbed frames upon which the grilles are clamped. The conveyor travels at the rate of 22 feet a minute. Form faced wheels, 10 inches in diameter, to fit into grille curves, on floating shafts, belt driven by individual motors, are suspended over the conveyor. There are 40 wheels in this machine and each rib receives 5 passes. Wheel speed is 2,750 r.p.m. Hide glue is used for sizing and mounting the heads of No. 200 Turkish emery. The latter is preferred over artificial abrasives as it produces a smooth surface with less deep scratches and does not glaze as easily.

Low spots on the grilles are hand polished on form faced wheels at 3,500 r.p.m. using Turkish emery as above.

The grease sticks used contain 75% saponifiable fats having a titer or melting point which is specified to be 118° F. in winter and 124° F. in summer.

Preliminary Soak and Cleaning:

To prevent undue contamination of the electrolytic cleaning solution, it is necessary to remove most of the polishing compounds in a preliminary cleaning operation. Several mechanical methods have been tried and, while most of them would remove the grease and drawing compounds, they would not completely remove the "black smut" of burned cotton, emery and iron oxide dust that is ground into the polished steel surfaces. Many proprietary metal cleaners were tried without suc-

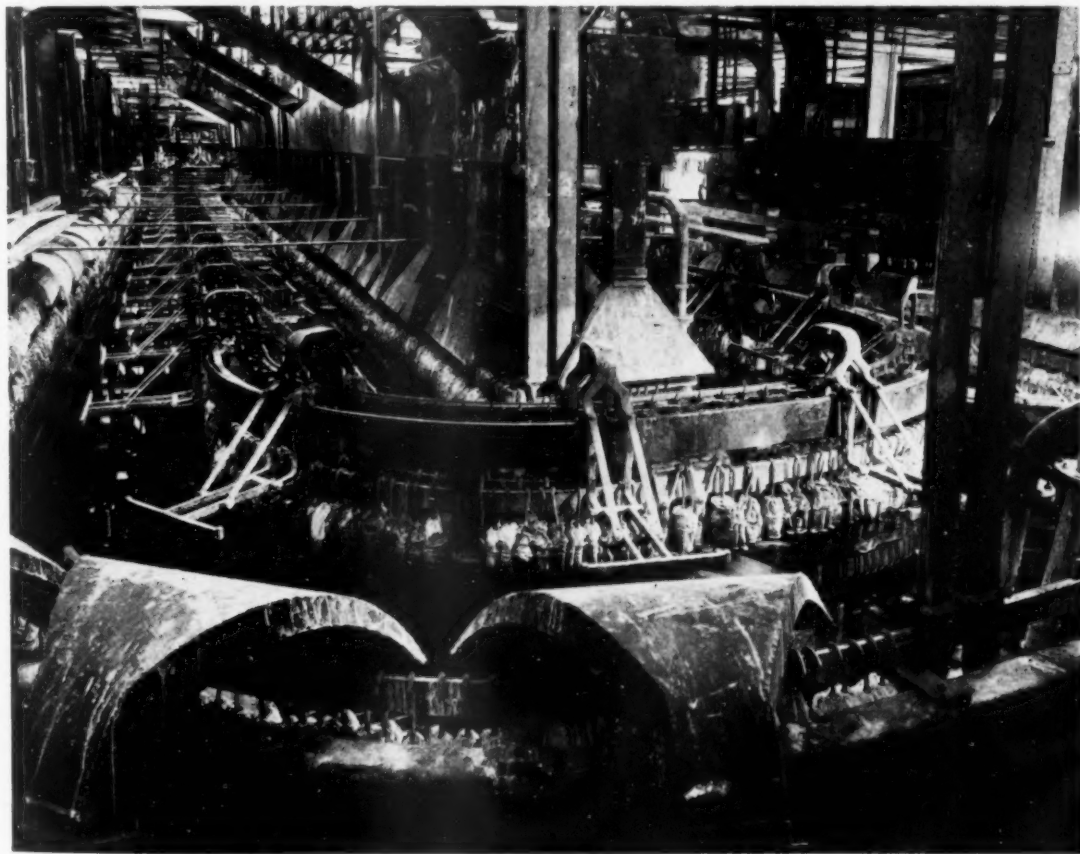


Fig. 3. View of plating machine at opposite end from loading station. Shows type of carriers riding on bus bars.

cess. The only satisfactory method was by soaking in a fairly strong, 8 oz. per gallon, solution of a trade metal cleaner containing a wetting agent, followed by hand scrubbing. This soaking and hand scrubbing is repeated in a second tank before the grilles are racked on the plating machine.

General information as to the plating operation is given in the following table:—

Size of grille	33" high as plated, 18" wide, 7" deep
Surface area, total	7 square feet
Surface area, significant	3½ square feet
Production per hour	330 grilles
Thickness of deposit required	0.001" minimum
Number of grilles per rack	2, back to back
Number of racks per carrier	2
Chain speed	54" per minute
Transfer time	44 seconds
Transfer lift	57"
Plating time:	
Copper strike	4 minutes
Nickel plate	25 "
Carrier spacing	40"
Tank depths	5 feet
Tank widths	7 feet, 10 inches
Distance of cathode to:	
Copper anode	20"
Nickel anode	18"

The grilles are loaded two on a rack, back to back. This arrangement calls for greater current carrying capacity per rack, but gives a heavier comparative coating on the front than on the back of the grille and results in a great saving in anode usage.

The following table gives plating machine data as briefly as possible:—

Following the plating with copper and nickel in this machine, the grilles are given a light buffing to bring them to an even color and are then plated with chromium in another full automatic. No further buffing is required and the grilles are then crated for shipment to the assembly plants located in various parts of the United States.

To those actively engaged in electroplating, some questions may suggest themselves in considering the above data; such as, why such a cycle was chosen and such concentrated nickel solutions and high temperatures are used. It may be replied that they were found most suitable for over five years of experience under our own plant conditions and as affected by the size and design of the part that had to be processed.

A thicker copper deposit from a cyanide solution with less nickel to make up the one-thousandth of an inch of total deposit was not found as economical as a copper strike and full thousandth of nickel under our plant set-up.

The distance from the work to the nickel anode was made as great as possible, so as to improve current distribution and give a more uniform thickness of coating, although it required a higher voltage to obtain the required current density. This was reduced by plating at as high a temperature as was consistent with long life of the rubber tank lining, which is about three years. Highly concentrated nickel solutions were also found essential, partly on account of the higher electrical conductivity, but also because, due to lack of floor space, it was necessary to deposit the full thickness in 25 minutes or less. In some models, this was obtained in 20 minutes. If the standard nickel solution of 35 ounces per gallon of nickel sulphate had been used, and a plating time of 35 minutes, the plating machine would have had to be 50 per cent longer, which was not possible. Space prevents our going into many other details that might be discussed and be of interest to the readers of METAL INDUSTRY.

Tank	Current			Time		Analysis Oz./gal.	Chemicals
	Capacity Gallons	Density Amp./sq. ft.	Temp. ° F.	Min.	Sec.		
Nickel Machines:							
Electric Clean	5,000	20	170	3	7	6	Caustic Soda
Cold Rinse	1,000				7		
Acid Dip	1,000				7	30%	Muriatic Acid
Cold Rinse	1,000				7		
Copper Strike	6,000	30	105	3	51	4	Copper Cyanide
						6	Sodium Cyanide
						1.5	Caustic Soda
Cold Rinse	1,000				7		
Cold Rinse	1,000				7		
Nickel Plate	33,000	70	160	25	7	68	Nickel Sulphate
						8	Nickel Chloride
						5	Boric Acid
Cold Rinse	1,000				7		
Cold Rinse	1,000				7		

American Hot-Dip Tinning Practice

2. Electrically Heated Hot-Dip Tinning Furnaces

By Wallace G. Imhoff

President, The Wallace G. Imhoff Co.
Vineland, New Jersey

There are many fields of tinning in the hot-dip tinning industry. To produce a high quality product, however, in all fields, requires a very detailed technical knowledge of the equipment and the process. In the various metal coating processes every type of standard fuel is used, electricity, city gas, natural gas, oil, and coal. Each type of fuel has its own particular advantages, and one special advantage may be claimed for tin pots heated with electricity, namely very accurate temperature control.

Hot-dip tinning is one of the most delicate metal coating processes, requiring not only a good practical knowledge of the process, but also the value of good hot-dip tinning equipment. If there are any two particular features of the process that may be cited as being very important to turning out a high quality product, these two features are the use of high quality materials, including a high grade soft Straits Tin, and temperature control equipment on every operation in the process.

It is only in the past ten to fifteen years that soft metal furnaces have been heated with electricity. A small electrically heated hot-dip tinning pot built approximately 13 years ago is still in use. This furnace has a pot 28 inches long by 22 inches wide by 5 inches deep. It

This is the second article of a series by Mr. Imhoff on American hot-dip tinning practice. The advantages of electrical heating for tinning baths are outlined.

has an input of 30 KW for connection to a 230 volt—3 phase power supply.

A more recent hot-dip tinning furnace is shown in Plate 1. This furnace is equipped with a tinning pot 72 inches long by 30 inches wide by 24 inches deep, and has an input of 80 KW on 230 volts—3 phase. It was designed for preheat tinning to handle 240 forgings 8 inches in diameter by 2 inches thick

per hour at a temperature of 500° F. The forgings were suspended on a short conveyor system equipped with motor drive which would permit 20

forgings to be heated at a time, allowing 5 minutes in the tin.

Plate 2 shows a five-pot electrically heated hot-dip tinning furnace with a large tin pot 40 inches long by 24 inches wide by 24 inches deep with an input of 40 KW, 230 volts—3 phase, operating at 600° F., and three intermediate pots measuring 24 inches by 24 inches by 24 inches each rated at 20 KW, single phase, 230 volts to contain palm oil at 480° F., tin at 560° F., and tallow at 560° F., respectively. The smallest pot measures 24 inches



Wallace G. Imhoff

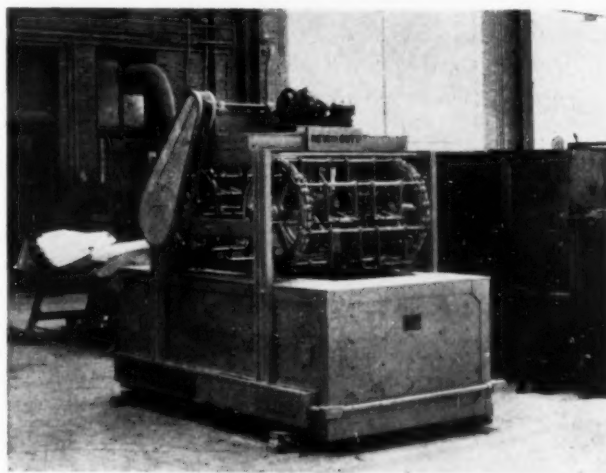


Fig. 1. Preheating tinning bath with conveyor mechanism. Pot 72" x 30" x 24"; input 80 KW, 230 volts, 3 phase, power supply. (Courtesy Hevi Duty Electric Co., Milwaukee, Wisc.).

long, 8 inches wide, and 4 inches deep. This furnace was built for the manufacture of electric refrigerator parts.

Attention has already been called to the importance of knowing all the temperatures in operating the hot-dip tinning process. This is because the tin and the greases are so sensitive to either overheating or underheating in so far as the quality of the materials used, and the quality of the product made is concerned. It therefore is essential not only to have temperature indicating and recording



Fig. 2. A five-pot electrically heated hot-dip tinning furnace. Large tin pot 40" x 24" x 24"; three intermediate pots 24" x 24" x 24"; smallest pot 24" x 8" x 4". Input large pot 40 KW, 230 volts, 3 phase power supply; input intermediate pots 20 KW, 230 volts, single phase, power supply. (Courtesy of the Hevi Duty Electric Co., Milwaukee, Wisc.).

pyrometers for each bath, but also even more important that the heating of all the baths be under very delicate control. This is the one very distinctive advantage of electric heat, namely, very delicate and accurate temperature control, and heating of the baths. Plate 3 shows one type of electric recording pyrometers.

Since considerable emphasis has been placed upon the quality of the raw materials and the temperature of the baths as a feature of producing a high quality product at a minimum manufacturing cost, a few words of discussion of these points will be given. The kind of tin used is of very great importance. It must be a very pure soft tin. This is a point which cannot be over-emphasized, as in one case where endless trouble was encountered, the solution was only obtained when the entire tin bath was discarded, and a new soft brand of pure tin replaced the old tin bath.

The impurities in tin are antimony, lead, bismuth, cop-

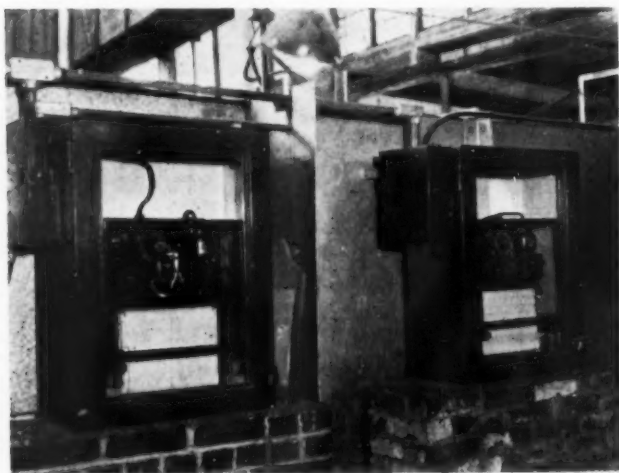


Fig. 3. Electric recording pyrometers. (Courtesy, Leeds & Northrup Co., Philadelphia, Pa.).

per, iron, arsenic, sulphur, stannous oxide, and small amounts of other metals. Iron if present in considerable quantities makes tin hard and brittle; arsenic, antimony, and bismuth, make tin hard and brittle, and if present to 0.5%, reduce its tenacity; copper and lead (1 to 2%) make it harder and increase its strength; tungsten and molybdenum make it less fusible; stannous oxide reduces its tenacity; and sulphur renders it "short." Tins carrying such impurities as antimony may be hard, and considerable trouble in hot-dip tinning; overheating the tin bath not only fills the tin full of oxide, scurf, and dirt, but contaminates it with iron which makes it very hard and brittle, reduces its lustre, and makes it wholly unfit for a tin coating.

In addition to the quality of the tin, perhaps the next most important material is the tinning grease. This must be a prime tallow, not a cheap, low grade tallow. In one instance, it took three months of highly concentrated research effort to locate the trouble in a tinning department making hotel and kitchen tinware, and the cause was at last located in the use of a very cheap, low-grade tallow.

Lastly, the solutions must not be allowed to become contaminated. Carelessness in carrying one solution into the next tank will eventually contaminate all the solutions, and bog the entire setup down with difficulties. It is therefore of paramount importance that the articles are very carefully rinsed clean before putting them into the next tank.

In conclusion, therefore, to make a very high quality hot-dip tinned product it is absolutely necessary to watch a few basic factors. Electric heat gives the advantage of very accurate temperature control of the tin bath, and offers a uniform application of the heat to the tin. Such accurate control preserves the quality of the tin by keeping it from being overheated, which is the main cause of high iron contamination and the formation of oxide, scurf, and dirt in the tin bath.

The second important factor is the quality of the raw materials used. This feature is especially important as regards the pureness and the softness of the tin used, and the quality of the tallow used. When two tin pots and two grease pots are used, the clean tin should always be put in the finishing tin pot, and the new tallow additions always added to the finishing grease pot. Tin for the rough tin pot is dipped from the finishing tin pot, and grease for the soaking grease pot is obtained from the finishing grease pot.

Finally, the third factor of great importance is the cleanliness of the baths themselves. When oil or grease are present from drawing compounds, or from any source, the articles must first be put through a good commercial cleaning bath. They must be thoroughly rinsed after each operation in order that they may enter each new solution absolutely clean, and not carrying over some of the contaminated solution of the previous tank. If all of these precautions are taken, and the men in charge understand the technique of hot-dip tinning, there is no reason why a high quality hot-dipped tinned product cannot be made.



High Speed Filtration

By Robert J. Green

Filter Division, Alsop

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The author discusses various uses for filters in addition to the usual use for filtering plating solutions. A new high speed, compact filtering unit is described as well as its use for filtering cleaning solutions, dilute pickles, cyanide plating solutions and the water used in plating.—Ed.

This paper describes some of the early methods of filtering plating solutions as well as the latest high speed unit. It is written from a practical point of view, dealing primarily with electroplating baths. However, there are other types of solutions used in plating practice that may be filtered, and these latter types will be touched upon briefly.

Home-Made Filters

Many of us have filtered nickel solutions through a woolen blanket or even an old felt hat, and we surely can recall the "headaches" accompanying this method. This was accomplished either by dipping the solution out of the tank with a bucket, syphoning or pumping the solution from one tank to another, and either fastening a couple of muslin bags on the end of the outlet hose, to act as a filter, or else using a small frame, usually constructed in the form of a square box open at both ends, to which has been fastened a woolen blanket. These were our filtering methods, which may seem ridiculous to the younger generation, but back a few years ago before the modern filter came into general use, the above methods were the only ones readily available. We had no other choice.

The Nickel Bath

Since it was a difficult job to filter a plating bath in those days, the usual practice was to clean and filter a bath about twice a year, and sometimes they were allowed to stand longer than that. The solutions in general use at that time were operated at room temperature, with a comparatively low metal content, and did not plate as fast as our modern nickel baths. Nevertheless, we have had the warm Watts bath for a number of years, which was in general use before we had an adequate method of mechanical filtration. Anyone who has operated such a solution over any period of time longer than six months, and has tried to clean and filter it with the older methods, has truly appreciated the advent of the small motor-driven portable filter. We are



Robert J. Green

all familiar with the troubles accruing from a rough deposit of nickel if it is the final finish, or if it is to be the base for a subsequent deposit of chromium, it is imperative that it be free from nodules or roughness.

The Need for an Efficient Filter

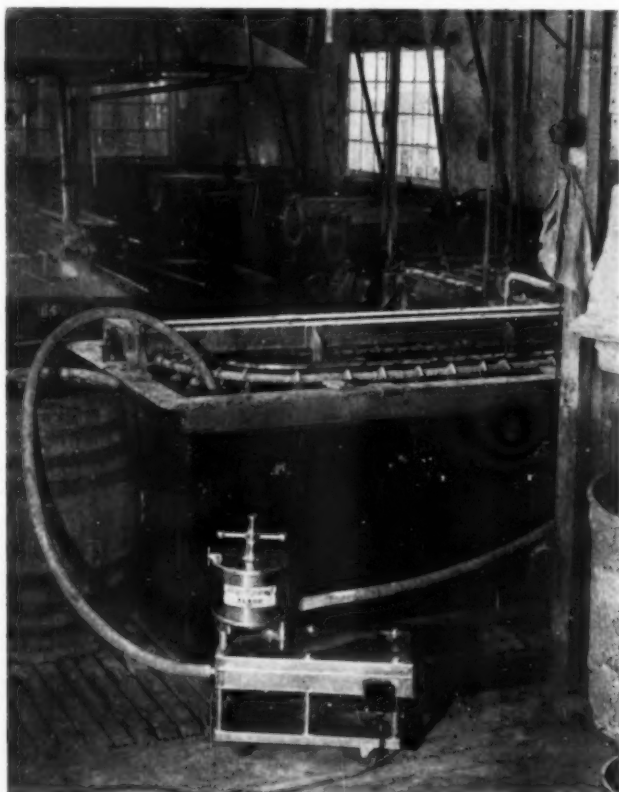
The demand for a proper filter has given us the familiar small portable unit, designed primarily for filtering nickel baths. It has to some extent been adapted for filtering other types of solutions as the various cyanide plating baths. This adaptation has been accomplished through the use of an interchangeable set of filter plates for use with the one filter. With this type of filter, one may filter in succession a nickel bath, and by washing thoroughly and changing the filter plates, filter a cadmium bath, washing and again changing the plates, filter a modern bright nickel bath.

This method is a far cry from the old methods. However, it has not gone far enough. It is a tedious job to change these plates, wash the filter, usually by pumping clear water through it, and filter other types of baths. In most cases, this type of machine is only used for one type of plating bath, due to the fact that one can never be positive that one has thoroughly cleaned all traces of different types of solutions from the filter. The limited use of this type of filter has resulted in the

neglect of the various cyanide plating baths, electro-cleaners, dilute acid dips, etc. The usual practice has been to allow the solutions to settle overnight, or for a given period of time, and to pump or syphon off the clear (?) liquid down to the sludge and then discard the latter, returning the solution to the original tank. This is a long, drawn-out process and has not proven satisfactory. In addition, the sludge often contains valuable metals, whereas with proper filtration these metals could be dissolved in the solution. As in the case of the nickel bath whenever they are stirred up, they can always be filtered.

Combined Plating and Cleaning Solutions

In the plating of some metals, it is common practice to use one of the cyanide solutions for a cleaner as well as a plating bath. As in the case of the silver strike,



A high speed portable filtering unit with capacity of 600 gallons per hour, filtering a bright nickel solution.

this bath is high in free cyanide and acts to some extent, as a cleaner. This is similar to the copper cyanide strike. In this category are the cyanide plating baths proper, though they do not have the same function as the strike solution because they have a much lower free cyanide content. Nevertheless, they do become contaminated with buffing compounds, etc., and certainly should be filtered as often as any other plating bath, and there are many platers who have special filters for these solutions.

We all know the giant strides the plating industry has taken in the past few years, and I think we all give due credit to the interest the technical engineers have in our practical problems and their solution.

Purifying Bright Nickel

With the arrival of bright nickel, came an imperative demand for more adequate filtration. We got it to some extent, but not by any marked improvement in the conventional type of portable filter (I am referring to the small type as used in the average plating shop) but by the use of filter aids as the diatoms and activated carbon. We are all familiar with the process of mixing these aids and adding them to the filter and while it is not difficult to make their addition, it does require time to mix and "set" the mixture on the plates of the filter. The messy part of it comes with cleaning the filter after using this mixture. This operation requires plenty of time and if we are to use this same filter for any other bath, it must be thoroughly clean. Of course, we have larger types of filters with very large filter areas. These are powerful units and their cost is usually in proportion to their size.

A Modern High Speed Filtering Unit

A recent development in the manufacture of filtering equipment has given us a filter that can be used with safety for practically any type of plating bath. It is designed for the sole use of the plater and due to its simplicity of construction, it can be thoroughly washed and cleaned in less than 10 minutes including re-assembly, resulting in less lost time between changes. The filtering medium is composed of specially treated filter fibres of a laminated construction in the form of a disc. These discs function as filter plates and are so economical they may be discarded at the termination of each run. The motor and pump are concealed under a splash-proof base and the unit itself is leak-proof. Just how radical this design is, may be seen from the fact that it may be easily carried by one man, yet under normal operation conditions it will deliver 12 gallons per minute and has been known to deliver 5 gallons per minute under subnormal conditions.

Subnormal Conditions

Subnormal conditions are plating baths which have not been filtered for a long period of time and which contain much sludge and suspended matter. One could not expect any filter to function effectively under such conditions. The obvious thing to do, would, in such cases, be to let the solution stand overnight if possible, with the heat turned off, then place the suction hose of the filtering unit just below the top level of the bath and start the pump, filtering the solution to as close to the bottom of the tank as is practical until the sludge begins to lift. When this occurs, stop the pump, shovel the sludge into a suitable receptacle and after thoroughly cleaning the tank, filter the clear solution back again. If using a high speed unit, this is a fast operation.

When all the solution has been pumped back into its original container, place the suction hose carefully into the receptacle containing the sludge and extract as much liquid as is possible, or until the filter clogs. It is then a simple matter to replace the discs, start the high speed unit and filter at near its maximum efficiency.

Preventing Contamination

Mention was made earlier in this paper of the prevention of contamination in plating, cleaning, and cyanide solutions and acid dips (the latter dilute).

In the case of the modern bright nickel bath, we may find after a given period of time or according to chemical analysis, that the bath contains impurities, such as vegetable matter and other foreign materials. The methods for purifying these solutions have been described in METAL INDUSTRY, and in the Monthly Review, hence, it is unnecessary to go into details of these methods at this time. Suffice to say that it is a long drawn-out process.

One of the main factors in plating is the condition of the water used in the tanks. Many of us have experienced trouble with our plating baths, cleaners and dips after a heavy rain, and we know that it is from the water supply but little has been done to rectify these conditions in a practical manner and for the average plating shop. Of course, we have had any number of water filters available during the past decade, such as the sand box and some mechanized units, but they have not met the need of the plater for a fast, quickly changed, efficient filtration.

With the modern high speed unit, it is no longer necessary to accept bad water conditions. If we filter this water before we place it into our tanks, we should eliminate a great deal of "headaches" attendant with bright nickel plating or any other plating room opera-

tion where water is used. I might say at this time that it is a well-known fact that brook and artesian well waters contain detrimental vegetable matter and colloidal inorganic material, such as clay, in profusion especially after a heavy rainstorm.

Increasing the Efficiency of the Electrocleaner

In regard to filtering electrocleaning solutions, cyanide dips, etc., it has been the practice in the past, to dump these baths when they have "broken down" or lost their efficiency. In some cases, this practice is feasible and in others, due to the relatively high cost of the material used in the cleaners, it is not. It is not only practical but desirable from an economical standpoint, to filter them to remove the grease, etc., to preserve not only the life of the cleaners, but to renew their cleaning action. The following method may be used: Let the cleaner stand overnight or until it is at room temperature. If one is using a steam coil, cold water may be run through the coil to cool the solution more quickly. When it has reached a normal temperature and the sludge has settled to the bottom of the tank, use the same filtering method described under subnormal conditions, with this exception, do not try to recover any cleaning compounds from the sludge as this material should be discarded. If using the high speed unit, it will be a simple matter to wash the filter thoroughly and change the discs; the filter is again ready for use.

We all are familiar with the plater's axiom, "an ounce of prevention is worth a pound of cure".

Metal Spinner Makes Good Beyond Expectations

An activity in metal work that is not often in the limelight, but whose exponents are kept more than busy turning out objects that are eagerly sought, is metal spinning. In Milwaukee, we find a company making a specialty of such work, and the demand for its product has increased to such an extent that expansion has become necessary on more than one occasion. This is the Milwaukee Metal Spinning Company, which had its beginnings in this country more than 35 years ago, when the elder Theodore Salow, expert at the work in Europe, came to this country to try his luck at his trade.

Originally Salow, after his arrival in this country, tried his hand at heavier work, but business in lighter metal spinning increased so rapidly in his shop that he decided to keep on with spinning lighter metal. However, today some heavier work than is ordinarily included in metal spinning is done at the Salow Works. As is well known, spinning, as it is usually done, when neat work is demanded without quantity production, consists of working flat metal into receptacles or objects by forcing it, while it is revolved rapidly on a lathe, against a wooden die. One reason for the increased volume of work coming to the Salow shop is this firm's ability to work metal up to one quarter inch in thickness, which is about four times

as thick as is usually spun. And now stainless steel is being used for this purpose, and attracting many orders to the Salow shop.

Up to the spring of 1936, this firm's place of business was a small one, but in that year, orders came in so fast that expansion was necessary. It was thought that the addition to the plant built in that year would take care of any business that could come to the firm for many years to come. However, by the fall of that year another addition to the plant became necessary and about a year later a third addition had to be put on, making the floor space about 10,000 square feet, an increase of 100 per cent over that occupied in the fall of 1936.

Although a modest man, Salow admits that with the present facilities, his shop, which is now under the management of Theodore Salow, Jr., is the largest exclusive metal spinning establishment in the world, able to spin metal up to 88 inches in diameter, and employing between fifteen and twenty expert spinners. With the addition of stainless steel, the future looks even brighter for this metal spinning concern, started 35 years ago by one man, who was uncertain at that time whether a metal spinner could really make a living in this country at his trade.

The Influence of Organic Compounds In Nickel Plating Solutions*

By Ernst Raub and Max Wittum

Forschungsinstitut fuer Edelmetalle Schwaeb. Gmuend, Germany.

The effects of about 100 organic compounds in nickel plating solutions have been investigated. It was possible to correlate the properties and compositions of organic compounds with their effects on the properties of the nickel solutions and deposits, and thus to explain the mechanism of addition agents in nickel plating solutions. Determinations were made of cathode potential—current density curves as well as chemical investigations of nickel deposits.

The immediate production of bright nickel deposits by the addition of so-called brighteners to the plating bath, has found increasing application during the last few years. Since the brighteners produce a marked refinement in crystal size of the nickel deposits, it is not often possible, even with high magnifications, to resolve the structure microscopically. Nevertheless, bright nickel deposits are usually not microscopically structureless as they show more or less distinct banding, parallel to the surface of the base metal. (Figure 1).

These bands, frequently observed in electrodeposits, indicate the co-deposition of foreign matter in a periodically changing sequence. Matte nickel deposits have a

deposit with less polarization than nickel and, therefore, they deposit in much higher concentrations in the coatings than their concentrations in the solution itself¹.

The conditions for producing bright nickel deposits by the addition of metallic salts, are maintained with difficulty, and, therefore, for example, cadmium salts, which have been used for some time are now used to a very limited extent.

The modern bright nickel baths operate with organic addition agents.

Although a large number of organic compounds have been found which will increase the brightness of nickel coatings, there has been little reported on the mechanism of the brightening action of these substances. There is a particular dearth of investigations on the correlation between the structure and composition of the addition agents, with their effects in the nickel plating solution. It is only known that certain of the compounds which produce brightness possess large molecules and dissolve in the colloidal state.

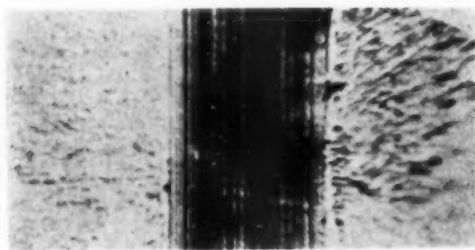


Fig. 1. Bright nickel deposit from a solution containing thiourea. Note the prominent banding. Mag. 650x.

more or less fine columnar structure. The crystallites grow perpendicularly to the base metal in the direction of the current lines. (Figure 2).

A great number of substances have been reported in different publications and patents for the production of bright nickel deposits. These addition agents are either metallic or organic compounds.

Metals which act as bright addition agents are: cadmium, zinc, iron, and lead, which are added as salts to the baths, and deposit as alloys with the nickel, but also to some extent, as with iron and zinc, as hydroxides in the nickel coatings. During electrolysis, these metals

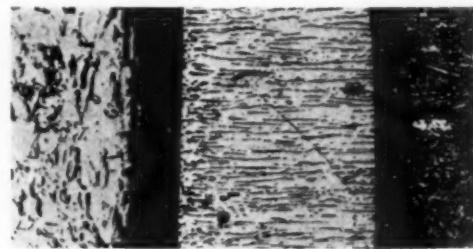


Fig. 2. A more matte nickel deposit out of the usual bath without addition agents. A columnar structure is evident. Mag. 200x.

A large number of organic compounds have been tested systematically. These compounds are of different types so that the influence of the type and structure of the compounds on nickel plating, can be clarified.

The following fundamental nickel bath was used in the investigation:

* Translated by Dr. Walter R. Meyer from "Der Einfluss Organischer Verbindungen auf die Galvanische Vernickelung", *Zeitschrift fuer Electrochemie und angewandte physikalische Chemie*, Volume 46, No. 2, February (1940), pp. 71-82.

1. E. Raub und M. Wittum, *Korrosion u. Metallschutz*, 15, 127, (1939).
E. Raub und E. Walter, *Zeit. f. Electrochem.*, 41, 169, (1937).
E. Raub und M. Wittum, *Korrosion u. Metallschutz*, 13, 269, (1937).

	g/L	ozs./gal.
Single nickel salts, $\text{NiSO}_4 \cdot 7 \text{H}_2\text{O}$	170	22.8
Nickel chloride, $\text{NiCl}_2 \cdot 6 \text{H}_2\text{O}$	30	4
Boric acid, H_3BO_3	25	3.35
pH	5.8	
Temperature	71.6°-73.4°F. (22°-23° C.)	
Current density: 2.8—14 amps./ft. ² (0.3—1.5 amps./dm. ²)		

The test pieces were plated with a current density of 9.3 amps./ft.² (1 amp./dm.²), with the same plating time. The base metals used were iron and brass sheets, some of which were buffed and others were only polished.

The restriction to one fixed fundamental plating bath, with fixed conditions, was done to specifically study the effects of different addition agents. It must be mentioned, however, that other bath compositions and operating conditions will give results which may deviate from the conditions chosen for this paper.

The mechanism for the influence of the addition agents was determined by their influence on polarization during nickel deposition, the reflectivity of the nickel deposits, and on the chemical properties of the deposited nickel.

The reflectivity was determined with a step-photometer using a suitable chromium or rhodium comparative mirror. The measurements ranged over the total spectral region of visible light. The reflectivity value determined by an incident angle of 45° gave forthwith an immediate value for the brilliance. If the reflectivity

of the nickel changed, however, under the influence of addition agents, then to determine the brilliance, both the spectral reflectivity and the diffuse reflectivity must be measured. The latter could only be determined, under the existent conditions, at an angle which deviated more than 8° from the direction of the spectral reflection. Therefore, it was not possible to measure the entire region of diffuse reflection. Nevertheless, it was possible to determine a decrease or an increase when the nickel deposit showed a reflectivity which deviated from that of pure nickel.

The adhesion and tensile properties of the nickel coatings were qualitatively determined by bend tests. In addition, hardness determinations were made with the micro Vickers hardness tester. However, these could not be quantitatively evaluated since it was not always possible to obtain thick coatings without experiencing peeling. Brittle deposits cracked during the hardness testing.

Determination of the micro-structure was made after etching polished sections in a mixture of concentrated nitric acid and acetic acid, in the ratio of one to one. Coatings of high brilliance were often not sufficiently etched and some even were not attacked in this solution. These were etched in the solution recommended by A. J. Krombholz², which is a solution of hydrochloric acid acidified alcoholic dimethylglyoxine. A total of about 100 organic compounds was investigated. They were added to the nickel solution in slightly increasing concentrations until a distinct impairing of the properties of the bath occurred.

EXPERIMENTAL RESULTS

Reflectivity Measurements of Nickel Deposits from the Experimental Bath, without Addition Agents

In order to determine the changes in the brilliance and color of nickel deposits caused by addition agents, the reflectivity of nickel deposits from the standard bath without addition agents, was first determined.

Figure 3 shows the reflectivity of nickel deposits, first in the state as they come out of the bath and also after buffing to high brilliance. They verify the acknowledged fact that with increasing thickness of nickel, the brilliance is sharply reduced. The spectral reflectivity for coatings 0.0006" (0.015 mm) thick is below 5%. With the thickness of only about 0.00014" (0.0035 mm) the reflectivity is six to seven times greater and almost reaches half of the reflectivity of highly buffed nickel.

The use of cobalt containing nickel baths has been proposed from various sources for producing bright coatings.

In Figure 3 are two reflectivity curves of alloy deposits which were obtained from the usual bath composition (without organic addition agents used in America³). The reflectivity of these alloy coatings is predominately like that of pure nickel coatings.

Influence of Aliphatic Compounds on Nickel Plating

Alcohols: methyl and ethyl alcohol, fermented iso amyl alcohol, glycerin

Methyl and ethyl alcohol, even in large quantities,

2. Trans. Faraday Soc., **33**, 511 (1937).

3. L. Weisberg, Trans. Electrochem. Soc., **73**, 435 (1938).

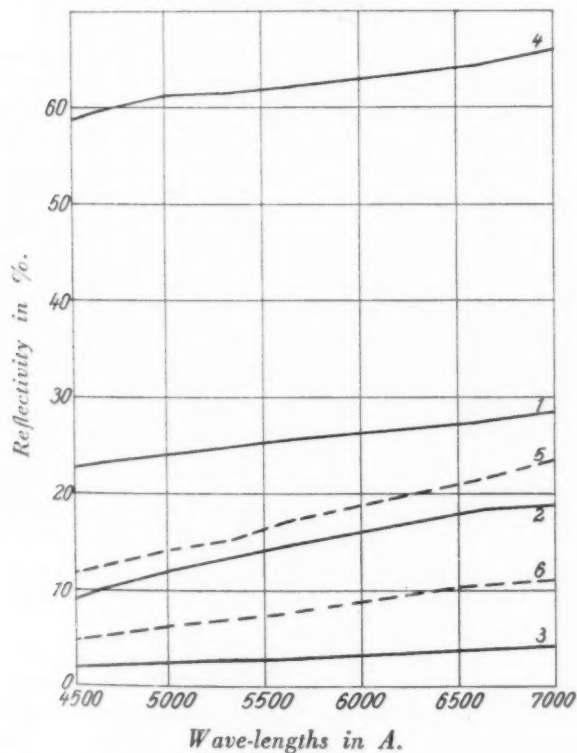


Fig. 3. Reflectivity of nickel and nickel-cobalt alloy deposits before and after polishing, (buffing).

1. Thickness of nickel deposit 3.5μ.
2. Thickness of nickel deposit 8.0μ.
3. Thickness of nickel deposit 15.0μ.
4. Nickel deposit buffed.
5. Nickel-cobalt alloy deposit, thickness 6.0μ.
6. Nickel-cobalt alloy deposit, thickness 12.0μ.

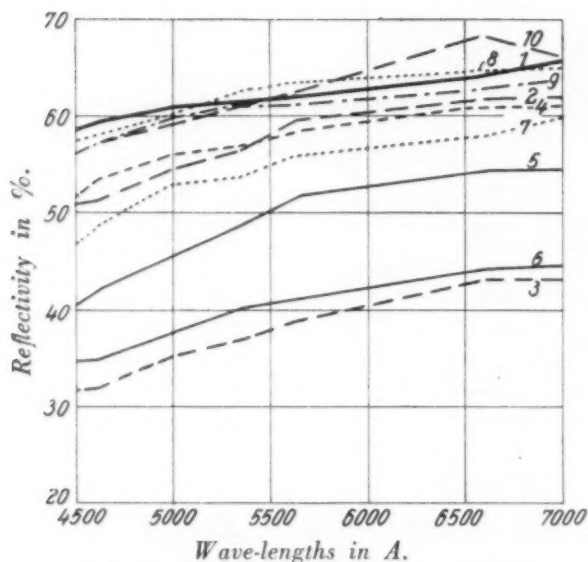


Fig. 4. Reflectivity of nickel deposits from solutions with additions of aliphatic compounds.

1. Standard bath, buffed.
2. 50 g/l glycerin, thickness of coating 6μ .
3. 50 g/l glycerin, thickness of coating 12μ .
4. 8 g/l formaldehyde, thickness of coating 8μ .
5. 15 g/l dextrose, thickness of coating 5μ .
6. 15 g/l dextrose, thickness of coating 9μ .
7. Ni-Co alloy bath with 35 g/l sodium formate. Thickness of coating 6μ .
8. Ni-Co alloy bath with 35 g/l sodium formate plus 1 g/l formaldehyde, thickness of coating 9μ .
9. 0.15 g/l thiourea, thickness of coating 8μ .
10. 0.08 g/l peptone, thickness of coating 12μ .

have no distinct effect on the nickel deposition. A bath saturated with iso amyl alcohol gave milky deposits, which, however, were only slightly less ductile than the standard deposits. Microscopically, distinct cross-cracks can be determined after bending the specimens 90° .

The tri-hydroxy alcohol, glycerin has no effect in small concentrations. Quantities of 50 cc per liter gave on the other hand, much brighter but milk deposits. Coatings with the thickness of about 0.00024" (0.006 mm) have a reflectivity only slightly less than that of the buffed nickel. Fig. 4, Curve 2.

These deposits showed a distinct golden coloration. The coatings became more matte with increasing thickness and the reflectivity decreased. Figure 4, Curve 3. The properties of the solution were impaired when the glycerin content was increased over 50 cc per liter. The coatings were non-uniformly cloudy and matte. Hydrogen adhered to the cathode in the baths containing glycerin more firmly than in the glycerin-free solutions, and pits appeared in increasing quantities. The cathode potential-current density curve was not distinctly displaced by quantities of glycerin in excess of 50 cc per liter.

Aldehydes and Ketones

Formaldehyde, Acetaldehyde, Propylaldehyde, Acetone

Formaldehyde markedly affects the nickel plating solution but enables the obtaining of brilliant nickel deposits whose reflectivities lie only slightly below that of buffed nickel and are independent of thickness (See Fig. 4, Curve 4). The brightness is only dependent on the treatment

of the base metal for thin coatings. Thick deposits are brilliant even on matte substrates. The structure of the nickel always shows a marked layering as illustrated in Fig. 1.

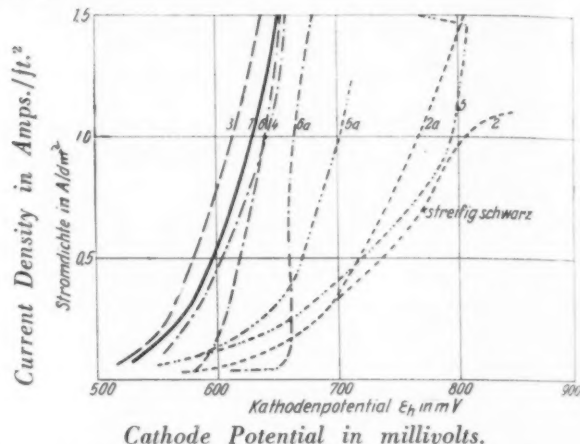


Fig. 5. Influence of aliphatic compounds on the course of the cathode potential-current density curves in nickel solutions.

1. Standard solution.
2. 16 g/l formalin, still solution.
- 2a. 16 g/l formalin, agitated solution.
3. 20 g/l dextrose.
4. 20 g/l sucrose.
5. 1 g/l thiourea, still solution.
- 5a. 1 g/l thiourea, agitated solution.
6. 0.04 g/l peptone, still solution.
- 6a. 0.04 g/l peptone, agitated solution.

The brilliant deposits are rather brittle. Crack formation occurs on bending but only in the spots subjected to the greatest deformation and exfoliation parallel to the layering is not observed. The brittleness increases with increasing thickness of the coating without noticeable decrease in adhesion. An unpleasant odor is noticed when the nickel deposits are heated, which is probably due to the decomposition of organic substances. Organic materials are co-deposited with the nickel from the solutions containing formaldehyde. The identity of these substances, however, has not been determined. Their co-deposition is based apparently on the ease of polymerization of formaldehyde by which colloidal material forms. Formaldehyde increases the polarization very markedly for nickel deposition (Fig. 5, Curve 2 and 2A).

In still baths, plating in the presence of formaldehyde at low current densities, results in brittle and black streaked coatings. In agitated baths, the polarization at higher current densities is less than in still solutions. The solution has its best properties with formaldehyde content from 1 to 1.4 oz./gal. (8 to 10 g/l).

Acetaldehyde affects the nickel deposition similarly to formaldehyde, its effect, however, being stronger. At the same time, an increased impairment of the mechanical properties of the nickel is observed, and the deposits, because of high tension, are covered with hair-like cracks.

Propylaldehyde, even in quantities up to 50 cc per liter, has no marked effect on the brightness. A definite increase in hardness and a noticeable decrease of ductility occur.

An addition of 10 cc per liter of acetone results in milky bright to bright deposits, which, however, have

(Continued on page 210)

The Future of Electroplating*

By Dr. Colin G. Fink

Professor of Chemistry,
Columbia University, N. Y.

If we compare the plating art of two generations ago with that of the present, we are startled at the many changes that have taken place—in particular as to the large number of metals now regularly and commercially deposited—and not only on brass, nickel silver and steel—but on a wide variety of base metals including die cast alloys, monel, aluminum, zinc, silver, nickel and cobalt.

George Gore, in his handbook on the "Theory and Practice of Electrodeposition; including every known mode of depositing metals, preparing metals for immersion, taking moulds, and rendering them conducting, 1865," gives instructions for the deposition of

antimony	copper
bismuth	brass
zinc	German-silver
cadmium	mercury
tin	silver†
lead	gold
iron	platinum
cobalt	palladium
nickel	

Of these 17 metals for which plating baths are stipulated by Gore, only four were plated on a scale approaching a commercial status.

Books on electroplating published subsequent to that of Gore's are not as "all embracing." With the introduction of the dynamo by Edison and by Siemens in the late 70's, the electroplating art expanded on a much larger scale than was possible theretofore.

Published formulas became more exact and claims made for the process or product became comparatively conservative.

Of the several plating books published during the fifty years after the introduction of the dynamo, the book by Blum and Hogaboom appearing in 1924 was the first to present the whole electroplating subject in a logical, scientific and comprehensive form. But even in that book, there is no mention of rhodium nor of chromium nor of nickel-cobalt alloy deposition—the plating of all three of which is today carried out successfully on a commercial scale. As a matter of fact, there have been more newcomers in the plating field since 1920 than there were between the appearance of Gore's book and Blum and Hogaboom's.

Future Developments

But what are we to expect in the next 20 or 25 years? There is every indication that the plating industry of the future will far excel in variety and fields of application the plating industry of the present. In a number of instances it is not difficult to prophesy because the preliminary steps toward new departures have already been taken.

No Mechanical Polishing

Thus, for example, mechanical coloring or buffing will not be required. Hereafter, a mirror finish will be produced right in the plating bath. There are in commercial use today plating baths for producing:

Bright chromium
" nickel
" zinc
" tin
" silver
" rhodium

and others are bound to follow.

In such cases as chromium, where a bright surface is necessary before applying the chromium, there are practical electrolytic "polishing" methods in use that have been very successful. Among others is the method of brightening 18-8 stainless steel that originated in our laboratories.



Dr. Colin G. Fink

Plating Before Fabricating

An outstanding development in the steel industry during the last few years is the introduction of the strip mill. Steel strip, several feet in width, is now being rolled in this country as well as in some foreign countries. The length of the strip is practically endless. This strip is now being plated with copper or tin or chromium and then fabricated into a wide variety of articles. There are a number of outstanding advantages in this "plating be-

* A paper presented at the Mar. 8, 1940 meeting of the N. Y. Branch of the A.E.S.

† The use of carbon bisulfide as a brightening agent for silver baths goes back to 1847.

fore fabricating" scheme. To begin with, there is a great saving in labor as individual racking is dispensed with. Then there is much greater uniformity in plate thickness. Metal baths with low throwing power produce the same uniform plate as baths with high throwing power. This, of course, does not apply when plating each individual reflector or cup-shaped article separately. Finally, there is the advantage of lower power consumption due to lower circulation polarization. The steel strip passing through the plating bath at a linear speed ranging between 50 and 300 ft. per minute, automatically and most efficiently renews the plating solution next to the surface of the steel.

Alloy Plating

Brass and cobalt-nickel baths have demonstrated beyond a doubt the commerciability of alloy plating. Many more alloys will soon join this small group—new nickel alloys, iron alloys, copper alloys, etc. Much of the experimental part of these new alloy baths has already been completed. In most cases it is merely a matter of standardization and the finding of simple means of regulation and control. In general, alloy plate is preferable over single metal plate when the alloy being plated forms a solid solution—that is, one metal dissolves in the other.

Rare Metal Deposition

A number of the rare metals possess valuable chemical or physical properties but on account of the high cost of these metals, the field of application in the bulk state is naturally limited. However, the electroplating art requires relatively small quantities of these precious metals

since only very thin layers of the metal need be applied. A striking example of this group of rare metals is rhodium, costing four times as much as gold and yet rhodium plated brass jewelry sells for "5 and 10." Small rhodium plated brass reflectors used in a number of the large department stores in New York City sell at a profit at 25 cents apiece. The thickness of the rhodium plate is about the same as that of the chromium plate on fixtures of your car.

Some work has been done on indium plated silver, but apparently further development is needed. Indium is very stable in the air and is unaffected by water. We have developed a new non-poisonous bath for indium and we believe that indium plated magnesium or aluminum to be possible on a commercial scale.

Palladium plating deserves further attention. Relatively large quantities of palladium are available—more than the present market will absorb. It is silver-white and is very stable in the atmosphere. The color is not as attractive as that of its sister metal rhodium, but it is decidedly cheaper than rhodium. One dollar's worth of palladium will cover about five times the surface a dollar's worth of rhodium will.

Gallium, germanium, thallium, rhenium and other rare metals can be plated—the baths are relatively simple and good deposits are obtainable—but further research is needed to find practical applications. Finally, better baths than those reported are needed for a half-a-dozen rare metals such as titanium, vanadium, columbium, uranium, zirconium and yttrium. There is no doubt in our mind that eventually the plating of these as well as other rare metals will become of commercial and material aid in extending the bounds of the plater's art far beyond those of the present.

THE INFLUENCE OF ORGANIC COMPOUNDS IN NICKEL PLATING SOLUTIONS—By E. Raub and M. Wittum.

(Continued from page 208)

poor adhesion to the base metal and exfoliate in scales even in the bath. Heavier coatings from acetone containing baths are gray to black gray.

Carbohydrates

Dextrose, Maltose, Lactose, Methyl Cellulose

The brightening effects of many carbohydrates in nickel plating solutions have been known for a long time. Dextrine, starch, and gum Arabic have been proposed variously as brighteners.

Solutions containing dextrose gave only milky bright coatings which required subsequent buffing to obtain the required brilliance. The brightness of the coatings decreased with the nickel plating time, which was little influenced by the solution temperature or current density. The reflectivity curves (Fig. 4, Curves 5 and 6), lie always below that of polished nickel, and in addition, a marked decrease of reflectivity in the blue and violet is to be seen. There is no increase in the cathode potential—current density curves from the use of dextrose and lactose (Fig. 5, Curves 3 and 4).

Lactose in concentrations of 4 oz./gal. (30 g/l), has little influence on the reflectivity of the coatings. At concentrations greater than 4 oz./gal., the deposits become again matte.

Dextrose and lactose have little effect on the mechanical properties. Their concentrations can vary over wide ranges without unfavorable effects. The concentration was kept appropriately between 2.5 and 5.4 ozs./gal. (20-40 g/l).

Maltose in concentrations of 0.67 ozs./gal. (5 g/l) results in streaky matte to brilliant coatings whose mechanical properties are poorer than those with dextrose.

The relatively difficultly soluble methyl cellulose has no influence on the properties of the deposits at a concentration of 0.02 ozs./gal. (0.15 g/l). The potential for nickel deposition is displaced about 20 to 30 millivolts towards the non-noble potential. During the electrolysis, noticeable scum formation occurred.

Acids and Esters

Formic Acid, Pyroracemic, Levulinic, Amyl Acetate, Acetoacetic Ester

Formic acid effects a weak increase in the brightness of nickel deposits. The mechanical properties remain unchanged.

(To be continued in May issue)

The Electrochemical Society To Hold Spring Meeting at Wernersville, Pa., Apr. 24-27

The Society will hold its Spring meeting at Wernersville, Pa., April 24-27, the program for the meeting being as follows:

Wednesday, April 24, 1940

7:30-9:00 p.m. Registration—Main Lobby.
8:00 p.m. Meeting of the Board of Directors followed by Annual Meeting of the Society—Solarium.

Thursday, April 25, 1940

8:00-9:30 a.m. Group breakfast.
8:00 a.m. Registration continued—Main Lobby.
9:00 a.m. Scientific-Technical Session on "Electric Steel"—Ball Room.
12:00-1:30 noon Luncheon.
2:00 p.m. Recreation or informal plant trips.
7:00-8:30 p.m. Informal dinner parties.
8:45-10:00 p.m. Entertainment and party—Ball Room.
10:00-1:00 a.m. Informal dance—Ball Room.

Friday, April 26, 1940

8:00-9:30 a.m. Group breakfast—Electrodeposition Division.
8:30 a.m. Registration continued—Main Lobby.
9:00 a.m. Scientific-Technical Session—"Progress in Electrodeposition"—Ball Room.
12:00-1:30 noon Luncheon.
1:30 p.m. Recreation or informal plant trips.
7:00 p.m. Reception to the newly elected President of the Society—Lobby.
7:30 p.m. Annual Dinner—no extra charge for Hotel Registrants, \$3.00 charge to others—Dining Room.
10:00-2:00 a.m. Dancing and floor show—Ball Room.

Saturday, April 27, 1940

8:00-9:30 a.m. Group breakfast—New Electro-Organic Division.
8:30 a.m. Registration continued—Main Lobby.
9:00 a.m. Technical Session or Recreation (Electrodeposition Session).
12:00-1:30 noon Luncheon.
1:30 p.m. Young Men's Meeting—Scientific Session on "Fundamental Electrochemical Subjects."
5:30 p.m. Adjournment.

Some of the papers which will be presented are as follows:

Thursday Morning Session—Electric Steel

The Present Status of the Electric Furnace in Industry. *W. E. Moore.*
The Electric Furnace in the Steel Foundry. *Frederick A. Melmoth.*
Electric Furnace Alloy Steels for Forgings. *H. P. Rassbach.*
Stainless Steel Rolled Products. *P. B. Greenwald.*
Some New Developments in Corrosion Resistant Steel. *George F. Landgraf.*

METAL INDUSTRY, April, 1940

Friday Morning Session—Electrodeposition of Copper and Other Metals

Progress In Electro-Refining of Metals. *Max Heberlein.*
A Study of the Electrolysis of the Sodium Cuprocyanide Solution. *J. V. Petrocelli.*
Stress in Electrodeposited Copper as Determined by X-Rays. *E. M. Mahla.*
Some Observations on the Structure of the Heavy Electrodeposits of Copper and Nickel. *J. W. Cuthbertson.*
Single Metal, Binary and Ternary Alloy Deposition from Thiosulfate Solutions. *D. C. Gernes, G. A. Lorenz, G. H. Montillon.*
Electrolytic Stripping of Copper From Zinc Base Die Castings. *W. B. Stoddard, Jr.*
Some Experiments Showing the Directional Reactivities of Single Crystals of Copper. *A. T. Gwathmey and A. F. Benton.*
Recent History of Cobalt-Nickel Plating *Louis Weisberg.*

Friday Afternoon Session—Galvanic Effects and Other Electrochemical Phenomena

The Application of Electromotive Force Measurements to Binary Metal Systems. *Harry Seltz.*
The Electrolytic Etching of Brass. *G. C. Williams and G. Rieger.*
Influence of the Rotation of the Base Metal in the Processes of Electrodeposition and of "Displacement" of Metals from the Solutions of their Baths. *Roberto Piontelli.*
X-Ray Analysis of Corrosion Products from Galvanized Sheets. *F. R. Morral.*
Irreversible Electrode Phenomena of Thallium. *I. M. LeBaron and A. R. Choppin.*
Photoelectric Cells Sensitive to Long Wave Length Radiation: The Bismuth Sulfide Cell. *Colin G. Fink and Johnstone S. Mackay.*
On Paste Compositions for Isolated Lighting Plant Lead Storage Batteries. *E. H. VanKooten and O. W. Brown.*
Cold Welding of Silver—II. *G. R. Van Duzee and J. M. Thomas.*

Saturday Morning—Electrolytic Oxidation and Reduction

The Theory of the Potential and the Technical Practice of Electrodeposit. I. *Charles Kasper.*
The Theory of the Potential and the Technical Practice of Electrodeposit. II. *Charles Kasper.*
Triple Ions and Transference Numbers. *M. Dole.*
Oxidation-Reduction Potentials and Their Applications: A Review. *Samuel Glasstone.*
Porous Carbon Electrodes. II. Oxidation of Arsenite. *Milton Janes.*

A Theory for the Passivity of Chromium. *Sister Aida Ryan and H. Heinrich.*

The Electrochemical Oxidation of n-Hexanol. *W. R. Lowstutter and A. Lowy.*

Electro-Organic Chemical Preparations. II. *Sherlock Swann, Jr.*

The Harmful Effect of Direct and Alternating Currents on Plant Growth.

An interesting program has been arranged for the ladies, and various recreational facilities are available for the members in attendance.

Plant trips will be available to various steel foundries and manufacturing shops in the vicinity of Wernersville.

On Saturday morning, a special student session will be held for all young men under 27 years of age, who are interested in any phase of pure or applied physical chemistry.

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Letters From Our Readers

On Current Distribution

The following letter was received in discussion of the editorial on throwing power, which appeared in the January issue of METAL INDUSTRY.

U. S. Department
of Commerce

NATIONAL BUREAU OF STANDARDS
Washington

February 9, 1940.

Dr. Walter R. Meyer,
METAL INDUSTRY,
116 John Street,
New York City.

My dear Dr. Meyer:

I wish to thank you for your favorable comments on my work on current distribution. We have gone considerably further than is evident from the papers thus far published. The problem of the effect of polarization has been rather thoroughly analyzed, and in some cases we have succeeded in finding ideal systems in which, under specified conditions, the effect of polarization can be computed by means of mathematics. These models form an admirable means of considering the effects of polarization in commercial practice. So far as they can be derived from a problem in geometry, the conclusions are analogous to those stated in your editorial.

I cannot comment on many of the practical points that you mention in your editorial, as obviously they are beyond mathematical consideration. The theoretical study does substantiate some of the points you raise, for example, (1) the throwing of the current is dependent on the absolute size of the object or recess. You will recall that you advised that question back in 1938. (2) When the observed throwing powers of two solutions differ widely, no measuring device is necessary. However, no correlation of measurements for which a device is necessary is to be expected between such measurements and general commercial practice.

Very truly yours,
Charles Kasper, Chemist.

+

In June 1935 at Bridgeport, and in June 1936 at Cleveland, the editor showed photomicrographs with apparently anomalous

degrees of throwing power of acid copper and nickel solutions in minute crevices, and expressed the opinion that throwing power may be dependent upon the absolute magnitude of the object concerned. This observation apparently went unnoticed until Dr. Kasper discussed the matter in papers to be presented at the Spring meeting of the Electrochemical Society, and in the following letter.

Feb. 20, 1940.

My dear Dr. Meyer:

I was very glad to receive your letter of February 16th and your encouragement. It has been my experience that the progressive members of the electroplating profession do understand the quality of the work, and they heartily support it. Of course, if one does not wish to put forth the time and effort in order to obtain a scientific comprehension of his problems, there is very little that I can do for him.

In regard to the effect of size on "throwing power", I may state that this is known but is not emphasized by practical workers. It may be a factor which makes possible the chromium plating in barrels of small screws, and I believe that there is an upper limit in the size of the screws.

I can analyze the particular case that you have observed in such a manner that it will be clear. Take particular note that I avoid the use of the term "resistance" as it is in the conception of that term that the apparent difficulty lies. In the inclosed figure I have sketched a

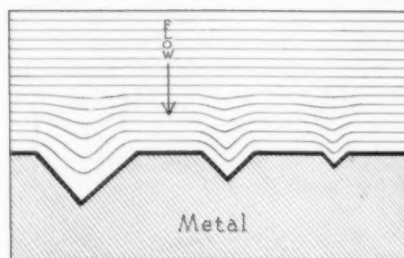


plate with several recesses of various sizes, and in each case I make the ratio of the width to depth the same. The separation between them is sufficient to avoid any question of mutual interaction, hence their only difference is in the absolute size. The auxiliary electrode is a plane parallel to this one and located an infinite dis-

tance away. Assuming first that the plate is an equipotential, the analysis of the problem of flow to it shows that at some distance from the plate, the flow will be linear, that is the equipotential surfaces will be equally spaced and the current flow will be uniform. Now as one approaches the plate, a spreading of the equipotential surfaces occurs and in the vicinity of the recesses a variation of current flow ensues. It is this distribution of potential due to the shape that causes the variation in current density. It is known that the variation in current density is conditioned primarily by the relative size of the recess, and not by its absolute magnitude. However, with polarization depending on the current density, a definite variation in the current will condition a definite variation in the potential. Its effect on the alteration of the spacing of the equipotential surfaces (which is a way of looking at the effect of polarization) will be dependent on the absolute size of the recess. As is evident from the figure this will be such that, if the recess is sufficiently small, the effect of any given potential variation can be quite large. This is about the clearest picture that I can give of the phenomena. The reason I have avoided the term resistance is that this quantity, contrary to popular opinion, is definable only for the total system. I have one system in which the total resistance, when the electrodes are equipotentials, is independent of the absolute size, and yet the effect of polarization increases with a decrease in size.

Very truly yours,

Charles Kasper, Chemist.

+ +

Stainless (?) Steel Needs Plating

New Britain, Conn.
March 24, 1940.

To the Editor, METAL INDUSTRY:

It was only a few years ago when electroplaters were told that "stainless steel—18-8" would displace electroplated coatings on steel. Some very positive statements were made that nickel and chromium plating on steel was on the "out" and platers better look for another vocation.

At the recent Chemical Show, the "18-8" metal was acknowledged to have some defects—it "pitted"! Silver in a very small quantity overcame that—but listen, read "18-8 and Related Stainless Steels—III" by Walter M. Mitchell, "Metals & Alloys," March 1940. Note last paragraph on page 93. They report that "the source of pitting

corrosion has been found in minute points, cracks and other imperfections in the surface of the metal. The remedy apparently consists in producing a self-healing film by various means, such as *plating with silver or other metals*, and by thermal treatment." (Italics mine.)

The tables seemingly have turned and the electroplater is called upon to make stainless steel a commercial product!!!

A word of caution to the plater—"if imperfections in the surface of the metal are to be welcome," then watch "What is Under the Plate."

George B. Hogaboom.

* *

On First Electrocleaning

Detroit, Mich.
March 10, 1940

My dear Dr. Meyer:

First, I wish to assure you that I am reading your publication and I am very much pleased to note your progress in the editorial role, and I wish you much greater success in this branch of the industry.

I note in your last issue of Post Scripts that you mention "electrocleaning was started in Chicago about 1910." I will not say positively that you are wrong, but I will state that I differ with you in that I know positively that I used it before then, and not in Chicago, but in Detroit in 1908. I am pretty sure that it was originated in Kalamazoo, Mich., by one Harry Wolverton of From Kalamazoo to You Stove Company. I believe Harry is still with that company.

There was another company in Cleveland, Ohio, who sold a cleaning composition for electrocleaning metals. I believe their name was the Cleveland Plater Supply Company. About that same time they really established the electrocleaning process, or in other words, put it over by aggressive advertising and salesmanship.

With regards,

Theodore A. Eichstaedt.

* *

Electroplating of Non-Metallics

New York,
February 18, 1940.

As an electroplater who has had thirty-five years' experience in the plating of non-metallics and galvanoplasty, I would like to challenge the article entitled, "Plating on Baby Shoes," which appeared in the Feb. issue of METAL INDUSTRY. I have plated on all non-metallics, some of which are plastics, wood, lace, china, glassware, and even a human appendix, and have both written and read literature on this art.

I must, however, admit that I have never read an article which shows such a complete lack of understanding of the art and which is so mal-informing.

To begin with, there is no cleaning operation necessary on a pair of baby shoes as this would tend to soften the shoes and possibly bring about adverse conditions in the actual plating. Secondly, on shellacing, it is all important that the shellac dries hard. The thinner in the lacquer tends to

make the surface tacky enough to take the bronze powder. Here the author has not described the importance of making sure there are no excess bits of bronze powder on the surface as this will tend to cause blisters. Next, the author states he plated in a solution which is composed of copper sulphate 7 parts to sulphuric acid 1. I have always found it wise to use 5 ozs. sulphate to 1 of the acid in a solution which contains anything up to 25 ozs. per gallon and $3\frac{1}{2}$ to 1 from there up.

At my plant, we deposit on an average of 1000 pounds per week and this ratio is always kept. Also the voltage required to start with, is no more than 1 volt pressure which may be increased after the shoes have been in the bath for about 1 hour.

Next and an error which makes me believe the author has not had much experience with plating non-metallics, is that he would have us believe plasters, flowers, wood, frogs, etc., may be plated in the same way. There is a different procedure necessary for each. For instance, plasters must first be dried thoroughly, then washed before an application of bronze powder may be made. For roses, lace, etc., liquid metallizers should be used. On leather, graphite is most beneficial, etc.

As a subscriber to your magazine, I ask that this be published so that your readers be warned against carrying out the operations described by Mr. Re.

I also challenge him to answer my corrections.

Yours truly,

Elias Schore.

Mr. Re's Reply

Detroit, Mich.
March 3, 1940.

Dear Dr. Meyer:

I have Mr. Schore's letter of the 20th and have noted the same very carefully.

The writer fully comprehends that he cannot please everybody. For example, a few years ago I was very badly criticized for my article describing my oxidizing solution which, nevertheless, is being used to this day. I was also criticized when my little book "Plating Aluminum Alloys" was published in spite of the fact that from 20,000 to 25,000 pieces of aluminum were plated per day on a production basis with the loss of hardly 3 per cent.

I was almost crucified for my polishing of hard rubber, celluloid and pyralin in tumbling barrels with my own mixture and wooden balls. This method resulted in the discontinuing of a night shift of three men because of reduced labor from my new process. I was bitterly approached about a buffing wheel which the writer made to buff in corners; yet it worked sufficiently satisfactory to increase production from 800 to 1100 parts per day. I also made the composition used for buffing and polishing the rubber, celluloid and pyralin, which composition was used for two years, and as far as I know, is still being used.

Without a doubt I may have been called a "screwball", for some of the many articles which I have written. I have had

experience, however, in plating objects from a needle to a locomotive, so to speak, and have answered numerous questions on various phases of plating.

The last pair of shoes which I plated, was in Chicago; the last fruit which I plated, was in Mishawaka, Ind. I have never tried plating china, and I am certain I have never tried plating an appendix (just the name gives one the jitters). There is no question that one may be able to improve the method which I suggested, which was based on five years of actual experience. There may be other methods, for example, to remove greasy shoe blacking, etc., from leather (no doubt, both Mr. Re and his critic are correct in regard to cleaning leather, as it is understandable that some leathers may be relatively clean and others badly contaminated with shoe polish—Ed.). Yes, the leather will soften somewhat in the process of cleaning, but when dried in an oven, it will harden. One should not, of course, burn the same during drying.

Let us travel back to the days of the horse and buggy. When the harness was placed in the barn wet, it became very hard and dry. We were then obliged to use neat's foot oil and muscle grease to soften the leather.

The first coating of shellac should not be anything new to any plater. It must be left to dry and when dry, it will become hard. However, the last coating, whether it be the second or third, should be tacky in order to have the powder adhere, and when dry (hard), the procedure of plating may then be started.

There is no question in my mind that any plater, without my telling it, knows that the article must be sprayed or brushed evenly. I have found also that after a treatment of shellac and powder, one can strike the work in a silver solution sufficiently to cover the coating with a whitish tint and then copper plate the same.

My point of view was not given to offend any one, for the old saying that there are a thousand-and-one ways of doing a thing, still goes, providing one can get results.

At the present time, the writer is only using nickel and chromium solutions.

Very truly yours,

Andrew V. Re.

* *

In keeping with the challenging atmosphere of Mr. Schore's letter, the editor has challenged Mr. Schore to prepare an article for METAL INDUSTRY on the subject. This challenge has to date not been accepted or answered.—Ed.

* *

Must Be Making Heavy Water

March 14, 1940.

Editor, METAL INDUSTRY:

Thanks for your editorial on the very limited use of hydrometers in solution control. In addition to the point you mention, i.e., an aqueous solution changes density with changes in temperature, dissolved solids other than those usually thought of, (Concluded on page 225)

SHOP PROBLEMS

Technical Advisors For April Issue

JOSEPH L. DOWNES

Finishing Superintendent
Remington-Rand Co.,
Middletown, Conn.

G. B. HOGABOOM, JR.

Consultant in Electroplating
and Metal Finishing,
Newark, N. J.

FRANK C. MESLE

Industrial Engineer,
Oneida, Ltd.,
Oneida, N. Y.

JOSEPH P. SEXTON

Superintendent of
Plating and Finishing
Sargent & Company,
New Haven, Conn.

When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Polishing Hollow Bowls

Q. We have a problem in polishing hollow bowls, either round or shaped like spoon bowls, where we have to polish them out and get a bright finish with a buff. We have been trying to cut down small felt buffs but they have to be so small, even for a teaspoon size bowl, that they do not last long. We are wondering if there is a special apparatus or a special buff made as far as shape as well as material, that will stand up and is used by spoon manufacturers who must have a more practical way of polishing hollow bowls.

A. I think the solution to the problem of polishing raised by this inquiry, is to substitute walrus hide for the felt. Walrus hide is much stronger and can be cut down small enough to polish the inside of a coffee spoon. These small wheels, of course, are used on the end of a pointed threaded spindle. Walrus hide generally is secured in flat pieces and the size of the wheel required is cut out with a band saw and then put on a lathe and trimmed to the shape desired.—F. M.

Barrel Black Nickel Plating

Q. I would like to know if black nickel plating can be done in barrels and what solution is used, if it is possible to do this.

A. Black nickel plating in barrels is being done on a production basis. A desirable concentration for bright nickel plating in a barrel of the samples submitted, would be:

Nickel ammonium sulphate. 12 ozs.
Sodium sulphocyanide
(thiocyanate) ½ oz.
Zinc sulphate 4 ozs.
Water 1 gal.
Temperature 70° F.
Volts 5 to 6

Inasmuch as the pieces are tube-shaped and light in weight, they will

have a tendency, therefore, to float, and steel balls or some other small parts should be added to the load to insure constant contact which is necessary. Drying should consist of a rinse in cold water, followed by a rinse in alcohol, and drying in a centrifugal drier.—J. L. D.

Oiled Bank Bronze Finish

Q. Kindly advise how a bank bronze type of finish is applied to brass and also to bronze, when the specifications read as follows: "Finished bank bronze by the oil bronze method, no lacquer to be applied."

A. As bronze finishes usually vary considerably in shade, due to the base metal used, aging, etc., it would be well to obtain a sample of the finish desired, to be a guide for color. The metal, whether brass or bronze, should be polished and cut-down buffed, although the polishing can be omitted in many wrought articles.

They should be then washed to remove buffing composition and scoured using water and fine pumice. Oxidize, using a solution of sodium sulphide for the bronze and yellow barium sulphide for the brass.

It will be necessary to use a muriatic pickle between the oxidizing dips to obtain color. Rinse and wet scratch brush with a fine steel wheel, or rub with sea-sand and water to relieve. Rinse and dry out in hot water, apply oil with a brush or cloth and wipe lightly. Castor is a good oil to use. It may be easier to finish the brass articles by bronze plating.

Most bank bronzes are of light chocolate brown color.—J. P. S.

Brass Plating of Cast Iron Lamp Bases

Q. We would like information with regard to brass plating and finishing of cast iron lamp bases. We

are brass plating our bases in a brass solution containing Rochelle salts with occasional additions of ammonia, using cast brass anodes and a potential of 3½ volts. After 20 to 30 minutes of plating, the base is dried in hot water, scratched on a fine wheel and oxidized in a cold solution of caustic potash and liver of sulphur. Our results are not satisfactory and we desire to obtain a rich, warm brown oxidized surface contrasted by highlights of rich yellow brass. Our brass is not a rich yellow but has a copper tinge.

A. A brass solution with a copper to zinc ratio of 4 to 1 will give a good rich color. The following formula can be used:

Copper cyanide	3.6 ozs.
Zinc cyanide	1.2 "
Sodium cyanide	7.5 "
Sodium carbonate	4.0 "
Water to make	1 gallon

Use 80% copper, 20% zinc rolled annealed anodes.

This solution must be run warm, about 100° F., to get good results on color. Ammonia (1 pint per 100 gallons) is added to a new solution. Control of the pH of a brass solution is desirable. G. B. Hogaboom in the April 1938 issue of METAL INDUSTRY suggested a pH of 12.2 to obtain the 80-20 ratio in the deposit. A. K. Graham, in the June 1938 issue of METAL INDUSTRY, gave further pH data. The pH can be controlled colorimetrically and for equipment for this purpose, consult advertisers in the METAL INDUSTRY.

For an "Old English" finish use: (#1) ½ ounce per gallon of liquid sulfur, and (#2), 2 ozs./gal. of copper sulphate, in separate crocks. Dip the clean work in #1, then without rinsing in #2. Rinse. If color is not deep enough, repeat. Instead of the copper sulphate in #2, a very dilute sulfuric acid solution (sour water) may be used. If shade is not deep enough, put a flash bronze over the brass before oxidizing.

It is believed that what you describe as brass with a copper tinge is really a "zinc pink" color. This shows too high a zinc content, and not, as you adjust for, too low zinc content. Suggest you have your solution tested and current density checked.—G. B. H., Jr.

Peeling and Pitting in Nickel Solution

Q. We have just recently started to have trouble with peeling and pitting of a cold gray nickel solution. We are using wetting agent to prevent pitting, but there are no tests available from the supplier indicating means for control. I would appreciate information on surface tension and the correct use of a stalagmometer.

A. The analysis of the solution is as follows:

Metallic nickel	2.7 oz./gal.
Chloride as ammonium chloride	2.4 "
pH	6.1

From the analysis, it would not seem that the solution composition is the cause of the peeling. It is possible that the temperature of the solution is too low. The solution should not be operated below 70° F. and should be preferably higher. The addition of 1 oz./gal. of single nickel salts, ½ oz./gal. each of ammonium chloride and boric acid and 3 fluid oz. of sulfuric acid to each 100 gallons is suggested to bring the solution up to the regular composition.

The stalagmometer is a simple device to use. It is only necessary to count the number of drops delivered between the lines marked on the device, both for the solution and distilled water at the same temperature. The specific gravity of the solution is then measured and the figures substituted in the following formula:

$$\text{Surface Tension} = \frac{D_{H_2O} \times S.T._{H_2O} \times \text{Sp. Gr. solution}}{D \text{ solution}}$$

D = Number of drops

S.T. = Surface tension

The specific gravity of water is assumed to be 1 in this formula. The surface tension of water varies with the temperature but is 72.8 dynes at 58° F. and 71.4 at 86° F., so that at room temperature between these figures, the surface tension of water may be taken as 72 without any appreciable error in the results. If a Baume hydrometer is used, the Baume reading must be converted to specific gravity units. In general the surface tension of the solution should be between 40 and 50 dynes per centimeter for good results. However, we would suggest that you follow the recommendations of the manufacturer of the wetting agent.

—G. B. H., Jr.

Iron in Brass Analysis

Q. We would like to know what procedure you would recommend to eliminate the effect of iron in the analysis of a brass solution for metallic copper.

A. The iron can be eliminated by filtering the solution before making acid for the thiosulfate titration.

The procedure would therefore be to remove the cyanide by boiling to fumes with sulfuric acid containing a few drops of nitric acid to oxidize the copper and iron. After cooling, the sulfate solution is diluted with water and made alkaline with ammonia and boiled. The iron is precipitated as ferric hydroxide while the copper and zinc remain in solution as the ammonia complexes. The ferric hydroxide is removed by filtration and the filtrate is made acid and titrated with thiosulfate according to the standard method. The zinc does not interfere with the titration and does not have to be removed.

In the Plating and Finishing Guidebook, 1939 Ed., p. 63 it will be noted that the solution is made acid with dilute acetic acid before titrating. Acetic acid is used because of the very limited solubility of the ferric hydroxide in its presence. For control work in electroplating this has the advantage of obviating a slow filtration and is sufficiently accurate for the purpose. If a large amount of iron is present, however, the red color of the precipitate makes the end-point of the titration less sharp.

For accurate work, filtration may be avoided by buffering the solution with sodium acetate and then adding 4½% solution of sodium fluoride until the red color of the ferric acetate is removed. Then add 10 cc. in excess.—G. B. H., Jr.

Silver Oxidized Finish on Tin-Antimony Alloy

Q. Silver or silver plated articles that are used become coated after a while with a yellowish color, and after being used a long time, with a whitish-gray color. Can you tell me the best way that I can get this effect on a tin-antimony alloy?

A. There is no good chemical method for producing an imitation silver oxidized finish on the alloy mentioned. If you wish to silver (Concluded on page 216)

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

Etching of Stainless Steel

(Extracted from "Polishing Technique for Stainless Steels" by W. M. Mitchell, *The Iron Age*, Oct. 26, 1939.)

Etching:

The development of successful etching processes for stainless steels has added greatly to their usefulness. Signs, nameplates, and material for decorative purposes in architecture are readily produced, and, when a grade of stainless steel such as 18-8 is used as a base metal, there is the advantage of complete permanence. For architectural applications, the etched surface may be overlaid with enamels of various colors, and truly artistic and distinguished ornamental material is thus made available.

Etching is usually done on polished surfaces, the higher the polish the greater the contrasting effect. Consequently, the No. 7, or the No. 8 finishes, are generally used as a base material for etching.

There are broadly two methods of etching which can be used on stainless steel—mechanical and chemical.

Mechanical methods employ an abrasive, either a charged polishing wheel, or brush, or the sandblast. Those parts of the design that are to remain bright are covered with a mask of adhesive paper, or tape, which is applied in whatever configuration is required by the design. The whole surface is then sandblasted with flint shot (must be iron-free abrasive) until the desired "etch" is obtained. By again blocking out portions of the blasted surface and sandblasting again, various grades, or degrees, of etching may be obtained giving one or more tones of shading. When the proper effect is secured the adhesive mask is removed with suitable solvent leaving those portions with their original brightness or luster.

Instead of the sandblast the tampico brush may be used. These portions of the design to remain bright are blocked out with adhesive tape, or paper, and the whole put under the brush for two or three passes. The brush dulls the bright surface and, when the mask is removed, the design is revealed in pleasing contrast. This process is very useful for producing striped effects; alternate stripes of tampico finish and mirror finish being useful for various purposes in decorative work.

The procedure for chemical etching is somewhat similar in that regions to remain bright are protected by wax, or some other impervious substance, while the unprotected surface is exposed to suitable chemical solutions which will attack it rapidly.

The method of protection of the surface is, however, different in the chemical process. A pattern, or drawing, of the design is first made in black and white on drawing paper. This is then photographed, and a flexible negative of the dimensions of the finished design made on cut film. This is printed on sensitized zinc and etched in the usual way to form the master plate.

This master plate is put in a press, covered with a thin sheet of rubber, and the design printed on the stainless surface with printer's ink. This is dusted with a powder composed of equal parts of rosin, pitch, and asphaltum. This powder, which must be very fine, adheres to the printed part, but not to the polished surface to be etched. The sheet is then baked at a moderate heat sufficient to just fuse the rosin, pitch, and asphaltum powder, and is then ready for the etching solution.

There are several etching solutions that may be used, as follows:

(a) Saturated solution of ferric chloride (FeCl_3) in hydrochloric acid, to which a little nitric acid has been added. This may be used full strength, or diluted for more moderate action. This is a powerful and rapid etching agent.

(b) An etching solution made up of 100 parts hydrochloric acid, 6.5 parts mercurous nitrate (HgNO_3), and 100 parts of water. This should be heated for solution, but should be used cold. It will produce a light etch.

Other solutions, containing hydrochloric acid or ferric chloride, may be made up, and some experimentation may be desirable in order to develop the best solution for a particular job.

When the surface is sufficiently etched, the acid is washed off, and the gum removed with gasoline or other solvent. As a matter of precaution it is desirable to give a final washing with dilute alkali solution to remove all traces of acid. This is followed by a final rinse in clear water and, if the surface is to be exposed to the weather, passivation with nitric acid should follow.

Chemical etching methods are preferred where enamels are to be used, as they cut deeper and give a sharper edge. Properly compounded solution will etch evenly without pitting, and will not undercut unless the action is allowed to go too far.

Electroplating with Silver

Birger Egeberg and Nathan Promisel (to International Silver Co.) U. S. patent No. 2,176,668, Oct. 17, 1939.

This patent relates to addition agents for producing bright deposits from cyanide silver plating solutions. The patent

refers to the use as brightening agents of such compounds as urea or other compounds of the general formula X-CO-NH_2 in which X represents NH_2 , or a substituted NH_2 group containing methyl, ethyl and other groupings.

Chromium Plating Baths Containing Fluoride Ions

Yu. V. Baimakov, K. P. Batashev and D. M. Telenkov. *Trans. Leningrad Ind. Inst.* 1938, No. 1, Sect. Met. No. 1, 27-35.

The authors investigated chromium plating baths of the following composition: Chromic acid, CrO_3 250 g/l
Sodium fluoride, NaF 0.5-10 "
Sulfate less than 1 "
Temperature range $15^\circ\text{--}45^\circ\text{C}$.

Best deposits were obtained from baths containing 2 to 5 g/l (0.27-0.7 ozs./gal.), and at current densities from 1 to 5 amps./dm.² (9-46 amps./ft.²), while in some cases, bright deposits were obtained with a current density of 0.5 amps./dm.². (This is a phenomenal low current density for chromium deposition and is open to question—Ed.).

Bright deposits were obtained at temperatures from $18^\circ\text{--}30^\circ\text{C}$. With increasing temperature, the throwing power dropped and at 35°C . was 16%. Lead anodes deteriorate rapidly in this solution. Platinum and magnetite (which had been treated in the chromium bath for 48 hours) were good for long periods of use.

SHOP PROBLEM

(Concluded from page 214)

plate the metal first, it can then be given an oxidized finish by dipping in a solution of potassium sulfide (liver of sulfur).

Potassium sulfide . . . $\frac{1}{4}$ oz. to 2 ozs.

Water to make . . . 1 gallon

Use hot.

If you wish to go into silver plating, formulas will be found on page 32 of the 1939 edition of the *Plating & Finishing Guidebook*, published by METAL INDUSTRY.

You may be able to get the finish you wish by means of lacquering. For example, lacquer with a clear lacquer, allow to dry, then rub on a black color ground in oil to darken the recesses. Wipe the highlights clean, then allow to dry. For this, or variations, consult lacquer manufacturers.—G. B. H., Jr.

Post Scripts

The writer met C. W. Morris of the Bias Buff and Wheel Company, Detroit, Mich., recently, in Toledo in the Nagle brothers plating shop. Mr. Morris acted as chauffeur to visit Lester Cope at the Dura Company to see a modern installation for plating zinc base die castings. Mr. Morris handed us the following qualifications to be used by embryo salesmen.

Salesman Must Have Hair on His Chest

A Salesman:

"Must be a man of vision and ambition, an after-dinner speaker, before-and-after dinner guzzler, night owl, able to work all day and drive all night and appear fresh next day; learn to sleep on the floor and eat two meals a day to economize on traveling expenses so he can entertain his friends in the next town.

"Must be able to entertain customers, wives, sweethearts, and pet stenos without becoming too amorous; inhale dust—drive through snow 10 feet deep at 10 below, and work all summer without perspiring or acquiring B.O.

"Must be a man's man, a ladies' man, a model husband, a fatherly father, a good provider, a Plutocrat, Democrat, Republican, or New Dealer, an old dealer and a fast dealer, a technician, politician, mathematician, and mechanic.

"Must be a sales promotion expert, create a demand for obsolete merchandise, be a good credit manager, correspondent, attend all dealer meetings, tournaments, funerals, visit customers in hospitals and jails, contact all accounts every six weeks, in spare time look for new business, do missionary work, and attend factory sales conferences.

"Must have unlimited endurance, and frequent over-indulgence in wine, women, wind and gab; a wide range of telephone numbers in all principal cities. Must have a car, attractive home, belong to all clubs, pay all expenses at home and on road on 5 per cent commission, plus 2 per cent excise tax, 1 per cent old age pension and 2 per cent lost sales tax.

"Must be an expert driver, talker, liar, dancer, traveler, bridge-player, poker-bound, golf player, diplomat, financier, capitalist, philanthropist and authority on palmistry, chemistry, psychology, physiology, dogs, cats, horses, blondes, brunetts, red heads, etc."

Los Angeles Celebrates

The Roosevelt Hotel, headquarters of Los Angeles Chapter's annual Educational Session, is on Hollywood Blvd., across the street from the Chinese Theatre, scene of big film premieres, where movie cuties are thicker than dust in a sand blasting room.

Had the out-of-town visitors to the Session known of this—I wonder, would there have been so many wives at the meeting? It was a caution to observe some of the delegates, strolling through the spacious forecourt of the theatre with the ubiquitous Missis on the arm, pretending they were interested in the footprints of movie stars imprinted in cement blocks. There were, as a matter of fact, much more interesting things walking around on top of the blocks. But whenever Mr. Electroplater's eyes appeared to stray, there would come a peremptory jerk on his arm and Mrs. Electroplater's frigid voice, saying: "This way, Edgar. Look! Here's Victor McLaglen's footprints. My, aren't they huge?" So what could our poor Edgar Electroplater do, but admire Victor's paw prints?

Carl McClaren started something when he popped a question during the Q. and A. period at Los Angeles Branch meeting in March. McClaren wanted to know how to reduce free cyanide in the solution. He explained that his firm—Cannon Electric Co.—had a customer who first wanted a yellow brass, then changed his mind to red bronze, switched to regular bronze, and finally demanded brass.

"And we had only one brass tank," said McClaren.

From across the room came a chuckle. It was Don Bedwell. "That must have been a noble solution by the time you got through messing around with it," he remarked. "I've seen the time you could have gotten all those colors out of the same batch, and maybe red, white and blue to boot."

Among the things touched upon by Dr. J. P. Russell during his talk on health hazards in the electroplating industry at the March dinner meeting of Los Angeles chapter was nickel itch.

A short time later a waitress was passing a saucer for tips, which are later equally divided among the several waitresses.

"Say," she said to Chairman Ray Bray. "That doctor fellow was talking about nickel itch. I hope your friends here aren't afflicted with it. Tell 'em for me, if they gotta itch, to get the two-bit itch—and put it in the saucer."

While on his recent Pacific Coast trip, Wilfred McKeon, Sulphur Products Co., Greensburg, Pa., introduced a new copper stripping solution to electroplaters. Free advertising is not the purpose of the Post Scripts page, but if readers can pick the trade name of the product out of the following sentence, Mac is welcome to the plug:

"Hoodlums in the river front district are getting out of control of the police. Last night they ran the copper off his beat."

Tom Chamberlain sported some bruises a month ago from a wild bobsled ride. Some of the other Chase boys and Tom decided to emulate the Stevens brothers at Lake Placid and tried the bobsled run at a Waterbury country club. The slide was coated with ice and instead of going the usual modest 60 miles an hour, they flew, and everything was grand until they landed. Tom, thanks to good padding in the gluteal region, escaped with bruises in the aforementioned region but his playmates were not so fortunate. Tom must live right.

A fellow native of Waterbury, Fred R. Kellogg of Apothecaries Hall Co. was also seen limping recently although Fred's limps were not from bobsledding but from skiing. We all can't be Torger Tokle's, Fred.

William "Bill" Torrance of Matchless Metal Polish Co., Glen Ridge, N. J., is now on the road to recovery, in the Presbyterian Hospital, Newark, N. J. Bill has been a patient in the hospital for over 4½ months, undergoing two operations, and reports that he hopes to be out of the hospital in about two weeks, and to soon be back in the field, calling on his old friends.

"James," asked the professor, "what are the three words most used among college students?"

"I don't know," replied the freshman.

"Correct!" said the instructor.

Frank J. Hanlon of Chicago, Past Supreme President and Past Supreme Secretary of the A.E.S., was among the distinguished visitors at the annual Educational Session of Los Angeles Chapter in Hollywood on March 30. Mr. Hanlon and his wife motored out with Mr. and Mrs. Oscar Servis. The Sonja Henies, Greta Garbos and other Scandinavian charmers of movieland left Frank unperturbed. Let Servis take care of the Swedes and Norwegians, was his attitude. Me for the Irish colleens, like Margaret Sullavan, Maureen O'Hara and Marlene Dietrich. . . . Since when has Marlene become Irish? . . . She hasn't, says Hanlon, but she's plenty "becoming" in other ways.

Leroy Beaver must now rate as the world's fastest talker now that Floyd Gibbons has passed away. Incidentally, H. N. R., Leroy talks extemporaneously, and how!

Walter R Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Nickel Stripping Process

The Chemical Corp., 93 Broad St., Springfield, Mass., have developed an addition agent called, "Stripode", to speed up the stripping of nickel deposits and to protect the base metal during stripping.

Stripode can be added to sulphuric acid strips of any concentration, and it is stated, saves acid by stripping faster and by preventing pitting and roughening of the base metal.

Several users have reported marked savings by the elimination of sand blasting and cutting down buffing operations by virtue of decreased attack on the base metal. From $\frac{1}{4}$ to $\frac{1}{2}$ oz. per gal. of the addition agent is used.

The stripping referred to is that of making the work the anode in sulphuric acid, using voltages from 6 to 12. The addition agent, because of the reduction of attack on base metal, is recommended for use in stripping plating racks, thereby increasing the life of the rack.

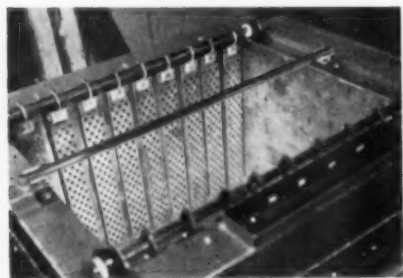
Literature and directions for use can be secured by writing the supplier.

Electrocleaner Anodes and Hooks

Storts Welding Co., Meriden, Conn., have announced the sale of perforated steel anodes for use in electrocleaning tanks. The anodes are made of 3" x $\frac{1}{4}$ " steel, with holes punched in alternate rows of 2 and 3.

The hooks are of high copper content designed for use on $\frac{3}{4}$ " diameter to 1 $\frac{1}{4}$ " diameter round anode bars for 2 point, knife-like contact with the anode bars. The hooks are Storts-brazed securely to the steel anodes and are supplied in two shank lengths "S" and "L" known as "short-shank" and "long-shank."

Length standards of anode material are maintained as stock for immediate shipment. In cases where standard lengths are too long, cut offs to desired lengths will be furnished at the standard length price, without extra charge. The stand-



Row of perforated steel anodes in alkaline electrocleaning tank.

ard lengths range from 19 $\frac{3}{4}$ " to 43 $\frac{3}{4}$ ", for use in tanks varying in depth from 24" to 48."

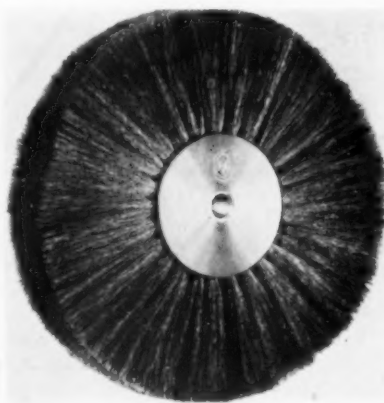
The sturdy construction is said to insure long life and the perforations enable higher current densities to be obtained with the same voltage, because of lowered anode-solution interface resistance.

The Udylyte Company, Detroit, Mich., have been appointed distributors.

New Scratch Brushes

A new type of scratch brush has been perfected by the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies, called "Metl-Hub" brush, which includes in its design, a number of special features.

The Metl-Hub brush has a one-piece circular metal hub of light weight alloy. This hub will not warp, split or check as wooden hubs so often do. The face of the hub permits the drilling of holes for the brush tufts close to the edge of the block, thus eliminating most of the projecting shoulder and lessening the danger of the operator striking the work against this shoulder. The metal hub, due to its high strength compared with wood, is of small size and also because of its high strength permits the use of an oversize arbor hole. This type of hub is always in perfect balance, reducing power costs, vibration and wear and tear on the spindles and motors.



Metal hub scratch brush.

The holes for the tufts are automatically spaced, drilled and countersunk by machine to give the tuft a firm seat in the metal block. They have no sharp edges to cut the tuft. The tuft holes can be set closer together, reducing the spaces between the tufts and the rows of tufts, which results in more continuous scratching and polishing action.

Permanently tight tufts are assured by

the use of drawing wire of high tensile strength wedged individually into the sides of the holes by special methods developed by the manufacturers' plant.

These brushes are guaranteed for their life against defective material and workmanship. They will handle all types of wet work as there is no danger of warping or splitting the hub. They are made in all diameters with any number of rows and in a variety of hub and arbor hole sizes. Steel, brass and nickel silver wire of all sizes may be used, as well as Tampico bristle and hair.

Centrifugal Wire Mesh Basket

Roelock, Inc., Southport, Conn., have announced an improved centrifugal wire basket.

This basket, made of wire mesh to give quick and complete drainage, is assembled by electric arc welding in such a manner, it is reported, that there is no possibility



Centrifugal wire mesh basket.

of the mesh pulling away from the frame at any point. The frame and mesh are sturdily designed to remain in shape in handling heavy loads at present high speeds.

There is a choice of several meshes to give the desired openings. This basket is made in plain steel for drying and lacquering and in Monel metal, stainless steel and nickel chrome for use in acid pickling, in addition to the centrifugal working, to eliminate necessity of changing the work from one container to another.

pH Tester

Wilkens-Anderson Co., 111 N. Canal St., Chicago, Ill., have recently announced their new "Cameron" one-two pH tester, a direct reading instrument utilizing the sealed



Atlas Brass Foundry, Los Angeles, cast more than 14 tons of 1% Nickel bronze bushings, glands and cases for spillway gates on the Grand Coulee Dam. Nickel promotes a dense grained structure in cast bronzes, thereby assuring pressure tightness. In Nickel bronzes the tendency to shrinkage or internal porosity is greatly reduced. Foundry profits are protected by uniform quality of Nickel bronzes—your surest safeguard against rejects.

These cast bronzes
**EASILY BEAT
SPECIFICATIONS**

Coupling cases, stuffing boxes, nut tube glands and hub glands cast in 1% Nickel bronze by the Atlas Brass Foundry. These were used by Consolidated Steel Corporation, Ltd., Los Angeles, in fitting 81½' gate valves for the Grand Coulee Dam. Average tensile values from fifteen test bars exceeded specifications by more than 33%.

...aided by
NICKEL

The improved strength and toughness of Nickel bronzes and bronzes permit more compact designs. Though strong and tough, Nickel alloyed bronze materials are readily machinable. Using the right Nickel alloys in the right places will make foundrymen, shop men and customers 100% happier. Consultation on your problems is always welcomed.

1.
Coupling Cases

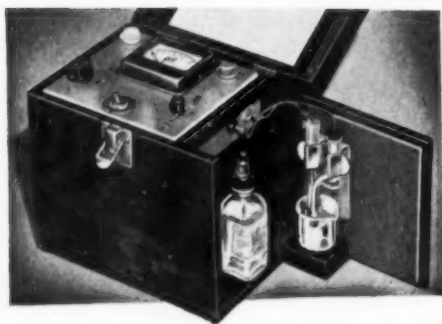
2.
Stuffing Boxes

3.
Nut Tube Glands

4.
Hub Glands



THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET
METAL INDUSTRY. April, 1940 NEW YORK, N. Y.



Direct reading electrometric pH meter.

glass electrode.

The instrument is self-contained and thus can be used for field or plant work. The calomel electrode used is ready for use with the addition of potassium chloride solution.

A single tube amplifier is built in and dry batteries used are of stock manufacture. The sample to be tested is poured into ordinary 30 ml. Pyrex beaker and placed on the support block. The electrodes are immersed in the solution and direct readings are rapidly obtained.

New Grinder

A new addition to the Hammond Machinery Builders' of Kalamazoo line of



Grinder for bulky work requiring wide working space.

grinders is the type "W" Wide Swing Grinder as shown.

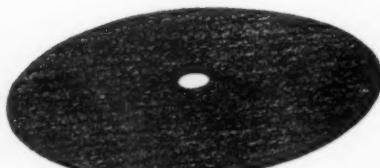
Pictured here is a 3 H.P. machine with totally enclosed motor, 14" boiler plate guards spaced 36" between wheels. This is a heavy duty grinder with spindle operating on four ball bearings and with a net weight of 915 lbs.

This grinder is especially desirable on bulky work or any application where extra working space around the wheels can be used to advantage.

For further information write the Hammond Machinery Builders, 1601 Douglas Ave., Kalamazoo, Michigan.

Insulated Grinding Disc

A new grinding disc has been announced by Abrasive Products, Inc., South Braintree, Mass., with the claimed ability to stand up under high temperatures generated in grinding.



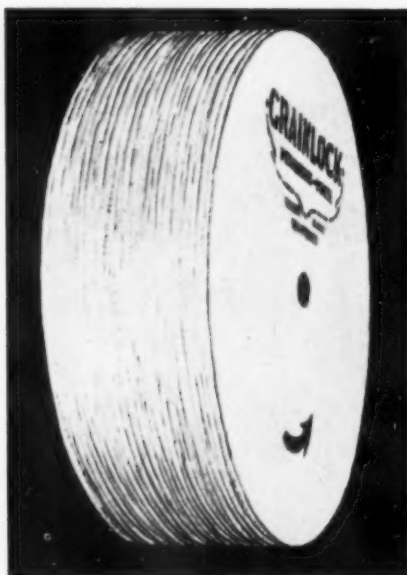
Insulated grinding disc.

Its heat resistance is said to result from a new binder used by the company which stays firm and holds grits in cutting position at temperatures up to 1800° F.

The discs are coated with special aluminum oxide grit which, according to the manufacturer, is capable of at least 25% more work than ordinary disc grits. The prevention against softening, filling or glazing by the new materials has been recorded in one factory test, to complete almost double the quantity of work over another type of disc previously used.

Grainlock Polishing Wheels

Industrial Lubricants Co., Inc., Detroit, Mich., have announced the production of Grainlock polishing wheels, which are new wheels using their Grainlock cement throughout instead of glue.



Cemented sectional polishing wheel.

In these wheels, individual buff sections are permanently secured with Grainlock cement, which is said to improve their operation under high temperatures and thus minimize the danger of wheel burning, as the various sections also serve as a fire-wall.

The cement is stated also to obviate sections of the wall coming apart.

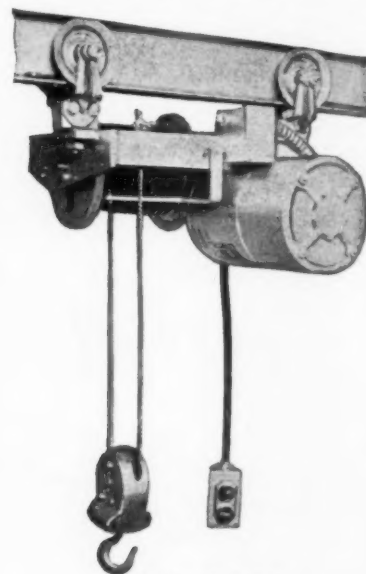
Greater efficiency, longer life and trouble-free operation are features claimed by the manufacturers for these wheels.

Aluminum Hoist

Electro Lift, Inc., 30 Church Street, New York, N. Y., announces a new, light weight, high speed, cable type electric hoist with all castings of aluminum alloy. This hoist is shown in the cut below.

It has been designed for the lightest possible weight consistent with the heavy duty service for which the hoist may be used. The light weight makes it especially suitable for applications requiring frequent moving and handling. It is also particularly suitable for use in steam and acid fumes on account of the non-corrosive properties of the aluminum alloy.

It is built in sizes of from 1/8 to 3 tons and has all of the speeds and ratings



Aluminum hoist.

Professional Directory

Any plating solution analyzed by professional chemists for only one dollar. We also sell reagent solutions at reduced prices.

Platers' Laboratory Service
1153 St. George Ave., Roselle, N. J.

G. B. HOGABOOM, JR. & CO.
Consulting Chemical Engineers
Solution analysis, plant design, process development. Testing of deposits—composition, thickness, porosity, salt spray.
352 Mulberry St. Newark, N. J.

Serving the Plating Industry
SCIENTIFIC CONTROL LABORATORIES
Consultant Platers-Chemists
COMPLETE Laboratory Service
20 cu. ft. Salt Spray
Trouble Correction Specialists
600 Blue Island Ave. CHICAGO

CUT COSTS, BUILD PROFITS
With Controlled Metal Finishing.
Tests, Analyses, Advisory Service.
JOSEPH B. KUSHNER, B.S. Ch.E.
Electroplating Consultant
192 Broadway N. Y. C.
Telephone COrlandt 7-1156

of standard Electro Lift hoists. It may also be equipped with traveling rope guide to eliminate the hazard of crossed or piled up cables where loads are pulled at an angle from the vertical.

The hoist has worm drive with worm and wheel running on Timken tapered roller bearings, fully enclosed within the gear case and running in a bath of oil. This provides simple construction and quiet operation. The motor has ball bearings and is directly attached to the hoist frame giving compact arrangement. The hoist has close headroom allowing the hook to reach within a minimum distance of the overhead track.

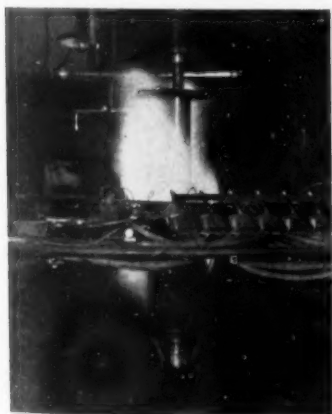
The control may be either rope or push button type. Top and bottom limit switches may also be provided to stop the load in each direction of travel, preventing running the cable off the drum and providing accurate stop at the bottom as well as at the top.

New Flame-Hardening Process Gives Greater Hardness

A higher degree of hardness in steel and alloy iron rolls, mandrels, etc., is being obtained by a new flame-hardening process developed by Linde Air Products Company and in operation at the plant of Farrel-Birmingham Company, Inc., Ansonia, Conn.

This new process is known as the Vertical Combination Method. By using it Farrel-Birmingham are able to raise the hardness of a 65-70 carbon steel cylindrical object to approximately 90 or better on the Type "C" Scleroscope. They have also tested the process considerably in hardening a special dry sand alloy cast iron known as "Farreflame," and have obtained an average hardness of 80 on the Type "C" Scleroscope.

Another advantage of this new flame-hardening process, according to Farrel-Birmingham, is the fact that in all the rolls that have been flame-hardened by the



Roll being flame-hardened by new vertical combination method.

Vertical Combination Method no measurable distortion has been detected. Overlap from the flame of the old progressive method of hardening is eliminated because the new process is continuous, uses a

large number of flame tips and is followed immediately by a water spray quench.

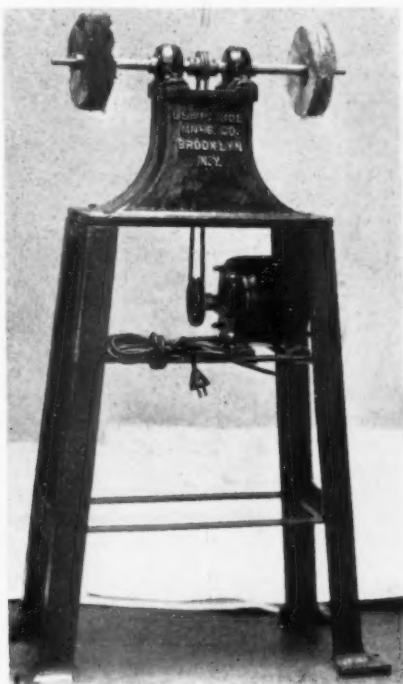
The Vertical Combination Method has proven very advantageous in many applications. Among these are the following: rubber engraving rolls, embossing rolls, calender rolls under certain conditions, different types of mandrels where excessive pressure or wear must be taken into consideration, certain applications for rolling mills, dough machines, wearing surfaces of bearers in printing machinery and numerous other applications.

Full information regarding this new process of hardening will be furnished by Farrel-Birmingham Company, Inc., to interested executives and engineers who care to write to the company's offices at Ansonia, Conn.

Light Duty Polishing and Buffing Machine

Lewis Roe Manufacturing Company of 1050 DeKalb Ave., Brooklyn, N. Y. have developed a polishing machine for light buffing and coloring to take the place of heavier machines for the same work. The machine consists of a head and stand and is driven by a 1/4 H. P. A. C. or D. C. motor which is mounted on the stand.

The machine is equipped with two self-aligning ball bearings and has a three quarter inch spindle twenty-two inches long. Longer spindles can be furnished if required. The spindles are turned down at the ends to one half inch and threaded



Light duty polishing and buffing machine.

eight square threads to the inch. The ends of spindle are tapped for taper points which are furnished with machine. A V belt and a device for keeping belt at a uniform tension is also furnished. The

motor has eight feet of cord and a switch. Machine weighs approximately one hundred pounds and the power consumption is approximately one cent per hour. It is very efficient for light work and is also portable.

Circulars and photos describing the machine more fully will be gladly sent to anyone inquiring for them.

Portable Dust Collector

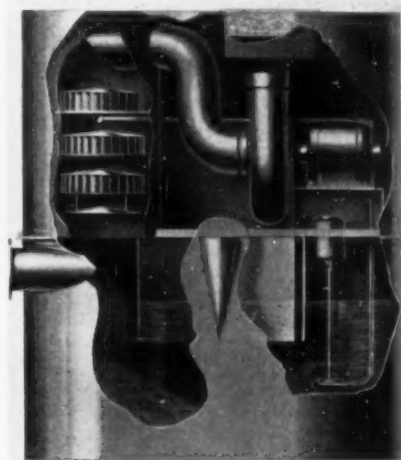
A new portable type wet method dust collector has been marketed by the Claude B. Schneible Co., 3951 W. Lawrence Ave., Chicago, Ill., under the designation Schneible midget multi-wash collector.

This unit functions the same as the company's standard multi-wash dust collector except that it is made only in six small sizes with a range of from 300 to 1500 c.f.m., and is a complete self-contained wet dust recovery system.

The machine is designed for the collection and disposition of dust and fumes arising from isolated operations that cannot be economically tied into a central dust collecting system.

It is therefore recommended for abrasive grinding, pulverizing, spraying and heat treating.

Fouled air is drawn into a miniature scrubbing tower where dust and fumes are



Portable wet method dust collector.

scrubbed out by spray walls and become impinged on a multiplicity of curved wet vanes arranged in several tiers. Impinged matter is washed down to a sludge chamber by the turbulent action of water introduced above the impingers. The washed air next passes through an entrainment separator to remove excess moisture and is then delivered to the plant atmosphere passing through a metal-wool diffuser and sound deadener as it leaves the unit. There are no bags or screens to clean out and no dry dust to handle. The sludge is settled in a dewatering compartment from where it is drawn off for disposition occasionally, the water or other washing medium being recirculated over and over. As only a small amount of water is needed, it can be put in by hand; no piping being required. Motors are com-

pletely sealed from dust and moisture and the manufacturer claims the unit has a comparatively low operating and maintenance cost.

The unit is a complete, self-contained dust collecting system, ready to plug into electric outlets.

Moisture Separator

The Logan Engineering Company, 4912 Lawrence Ave., Chicago, Ill., announce that their line of Aridifiers for removing moisture and oil from air and gas lines is now complete in all sizes from $\frac{3}{8}$ " to 10".

All sizes are said to effectively remove dirt and moisture from compressed air lines and gas lines, foreign matter impinging on a multiplicity of "propeller blades" revolving in opposite directions and propelled by the flow of air or gas. The arrested contamination and moisture is collected in the lower housing from where it is drawn off as occasion warrants.



Moisture and oil separator for air and gas lines.

All sizes are simply constructed, easy to install in any line, interior or exterior, operate without back pressure and require no maintenance or attention other than a periodical clean-out.

These units are designed for application to all compressed air lines in foundries such as sand blast equipment, jolt machines, strip, draw and roll-over equipment, shake-outs, air driven chippers, hammers and grinders, etc.

Aridifiers are pictured and described in Bulletin 939 now available which gives complete operating and installation details on units from $\frac{3}{8}$ " to 10" standard pipe sizes for gas or air cleaning and drying.

Process for Protection of Metals at High Temperatures

The Metallizing Engineering Co., Inc., 21-07—41st Ave., Long Island City, N. Y., have announced the development of a process

called, "Metcolizing", for the protection of iron and steel, and in some cases, copper and bronze, against oxidation and scaling at elevated temperatures. It is also recommended for the protection of nickel and nickel chrome alloys against attack by sulphurous gases.

The Metcolizing process consists of (1) a coating of special aluminum by the metallizing process to a specific thickness; (2) the application of a coating of a low cost liquid preparation over the aluminum coating, and (3) a specific heat treatment causing alloying between the aluminum and the base metal.

The compound coating is said to be strongly adherent, highly resistant to scaling and to withstand abrasion to a remarkable degree.

Scaling is prevented at temperatures up to 1800° F., and a limited protection is even afforded for temperatures up to 2000° F.

Manufacturers' Literature

Air Cleaners. Bulletin No. 340 of the Logan Engineering Co., 4912 Lawrence Ave., Chicago, Ill., is a colored 4-page bulletin describing the company's new line of air cleaners called "Aridifier". These devices are for removing moisture, oil and dirt from compressed air and gas by centrifugal force.

Air-Operated Controllers. Modern air-control instruments and their applications are discussed in a new catalog No. 4050 of the Bristol Co., Waterbury, Conn. Special attention is given to Bristol's free vane principle of operation in air-control. Their system of pneumatic and remote control is also explained.

Alloys. A 56-page data book, R-40, of the Driver-Harris Co., Harrison, N. J., which describes electrical heat and corrosion resisting alloys. Valuable data sheets on Nichrome sheet, wire, ribbon and coils are included.

Arc Welding Electrodes. This 40-page catalog, 1546F, illustrates and describes a complete line of arc-welding equipment, electrodes and accessories. To assist the user in making proper selection for any specific application, the various considerations ordinarily involved are outlined, along with a description of the characteristics and quality of each type of electrode recommended. A list of local G-E sales offices is given. General Electric Co., Schenectady, N. Y.

Bonded Metals. "Product Showmanship" is the title of literature recently distributed by American Nickeloid Co., Peru, Ill. It describes and gives simple facts of pre-finished metals, which include, bright chromium on brass; striped chro-

mium on tin, and satin chromium on copper.

Catalog. This literature contains information on "Select-O-Speed" variable speed transmission, "3-in-1" electric cleaner, electric soldering tools, precision grinders, wire strippers, and other products of the Ideal Commutator Dresser Co., 1250 Park Ave., Sycamore, Ill. Illustrations are included.

Controls. An 8-page catalog illustrating control instruments of the Sarco Co., Inc., 183 Madison Ave., New York, N. Y. Water blenders, cooling controls and temperature regulators are illustrated and described.

Electric Meters. A 12 page catalog, 1758B, featuring a complete line of rectangular switchboard instruments, and containing scales of actual size of G-E voltmeters, ammeters, and wattmeters. General Electric Co., Schenectady, N. Y.

Emulsifying. A new booklet, "Emulsifying with the Fatty Alcohol Sulfates", has just been issued by the Fine Chemicals Division of E. I. duPont de Nemours & Co., Wilmington, Dela. It contains a discussion of emulsions and the characteristics of "Duponol" alcohol sulfate emulsifying agents. Sections of the booklet are devoted to solvent, oil, wax and special emulsions and sprays, and various formulae for the preparation of the emulsions are included.

Fire Guns. The Hauck Manufacturing Co., 124—10th St., Brooklyn, N. Y., in their new bulletin No. 1034, illustrate and describe their "Fire-Guns." Nos. 249, 250 and 251 are recommended for general repairs requiring heat, and maintenance work, particularly for winter repair jobs. This torch outfit burns kerosene, coal oil, range oil or light furnace oil; also furnished for gasoline fuel where desired.

Floor Surfacing. The Flexrock Co., 23rd & Manning Sts., Philadelphia, Pa., have recently issued a 4-page folder describing their material "Concretdense" for water-proofing floors. The material is claimed to have high abrasion resistance, with acid and fire resistance.

Grinding Wheel Gradeometer. The Abrasive Engineering Corp., Detroit, Mich., describe their new Gradeometer in a booklet entitled, "What Do You Know About Grinding Wheels?". Their new portable Gradeometer for evaluating density, uniformity of structure and bonding strength of grinding wheels, is described.

Grinding Wheel Service. "Norton Service" is the title of a colored illustrated booklet describing various types of technical service rendered and available by consultants of the Norton Co., Worcester, Mass.

Hose. "Hose Hints" is the name of a catalog of the U. S. Rubber Company, Rockefeller Center, New York, N. Y.

which describes the construction of hose available to industry; fittings and couplings are also included.

Induction Motors. Bulletin No. 118 of the Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, Ohio, describes and illustrates squirrel-cage induction motors for two and three phase alternating current circuits. The motors have 40° C. continuous duty, open rating. Various component parts of the motors are illustrated.

Insulators. Catalog No. 280 of Barco Manufacturing Co., 1801 Winnemac Ave., Chicago, Ill., describes insulators to be used for all types of electrocleaning and plating tanks, to keep out stray electrical currents.

Nickel Chrome Castings. A well illustrated booklet showing the preparation of finished castings in the plant of the Standard Alloy Co., Inc., 1679 Collamer Rd., Cleveland, Ohio. Illustrations are given of various uses of nickel-chrome alloys.

pH Tester. Wilkins-Anderson Co., 111 N. Canal St., Chicago, Ill., have issued a four-page folder describing their "Cameron" one-two pH tester for measuring the full pH range in acid and alkaline solutions by the use of glass electrode and electrometric methods.

Photo-Electric Colorimeter. Principles of construction and operating details of the new "Lumetron" photo-electric colorimeter are described in a 6-page folder recently published by the Photovolt Corp., 10 East 40th Street, New York City.

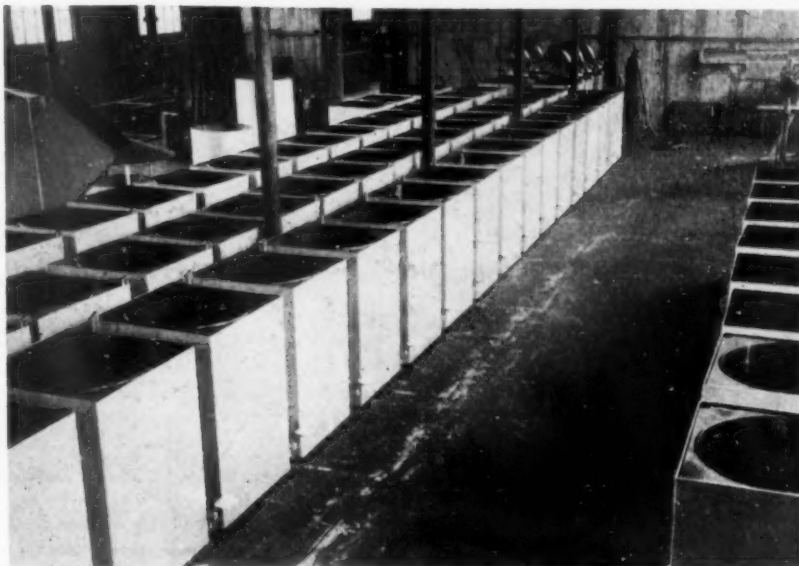
Porcelain Enameling Supplies. The Porcelain Enamel & Manufacturing Co., Eastern & Pemco Aves., Baltimore, Md., have just released a 33-page guide, giving standard specifications for porcelain enamel supplies. Specifications for purchase and control of such materials as bentonite, borax, clays, etc., are given.

Propeller Fans. A 32-page catalog, No. 12, of the Hartzell Propeller Fan Co., Piqua, Ohio, has recently been issued. This catalog illustrates and describes the company's line of propeller fans and blowers, giving complete air-delivery tables for each blower. Various sizes and models of equipment are described.

Pyrometers. To show some of the specialized temperature measuring problems to which "Rayotube" detectors are now being applied, Leeds and Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., has just issued a 40-page catalog. It pictures these tubes detecting temperatures of work in motion, and shows the instrument used for various still types of temperature measuring.

Refractories. A 50-page catalog which describes the "Shamva Mullite" refractories produced by the Mullite Refractories Co., Shelton, Conn. The contents of this catalog are devoted chiefly to illustra-

In One—Or A Hundred—Or A Carload— The Cost-Cutting Features Are The Same.



You'll find the same money-savings utility and functional features in every "Vortexeddy" Spray Rinsing Tank, regardless of the size you order . . . and when you order one and use it, you'll order additional ones for the same reason — TO CUT COSTS AND INCREASE PROFITS.

YOUR NEAREST UDYLITE OFFICE WILL GLADLY AND PROMPTLY SERVE YOU

The Udylite Corp., Chicago, Ill.
The Udylite Corp., Detroit, Mich.
The Udylite Corp., New York, N. Y.
The Udylite Corp., Cleveland, Ohio
J. C. Miller Co., Grand Rapids, Mich.
Donald Sales & Mfg. Co., Milwaukee, Wis.
L. H. Butcher Co., San Francisco, Cal.
L. H. Butcher Co., Los Angeles, Cal.
Electroplating Inc., Atlanta, Ga.
MacDermid Inc., Waterbury, Conn.
F. H. Bathke, St. Paul, Minn.

In the first six months of marketing, more than 30% of users of "Vortexeddy" Spray Rinse Tanks reordered additional tanks shortly after using the initial one.

Every "Vortexeddy" Spray Rinse Tank you order will furnish you the same cost-cutting features for your plating operations. Your gains are definitely assured.

A BOOKLET TELLING WHY IS YOURS
FOR THE ASKING—SEND FOR IT NOW.

STORTS WELDING COMPANY
MERIDEN CONNECTICUT

tions of typical applications of mullite in electric induction and arc furnaces, industrial boilers, open flame and crucible furnaces, glass tanks, ceramic kilns, iron and steel furnaces and other installations.

Revolving Flexible Joints. Catalog No. 291 of Barco Manufacturing Co., 1801 Winnemac Ave., Chicago, Ill., describes revolving type flexible ball joints to be used for supply steam, gas or other fluids from a fixed or stationary supply pipe to a rotating drum or member, without leakage.

Spraying Nozzles. Spraying Systems Co., 4021 W. Lake Street, Chicago, Ill. Catalog No. 20, describes and illustrates nozzles of various types for spraying. Suggestions for arrangements of nozzles in various types of washing apparatus are included.

Tanks. The Hauser-Stander Tank Co., Cincinnati, Ohio, have just published their catalog No. 40, entitled, "The Book of Tanks".

This book contains numerous available data on tanks such as volume for various dimensions, constructional data and information on the resistance of the tanks to various corrosive media.

The book contains many illustrations of tanks in use.

Valves. A recently published illustrated pamphlet by the Foxboro Co., Foxboro, Mass., describes the company's Stabilflo control valves for use in process control. A semi-logarithmic scale compares the flow curves of the company's valve with those of other valves.

Welding Equipment. A 4-page bulletin detailing "M.S.A." welding helmets and

STAINLESS STEEL POLISHING COMPOUNDS

Are Proven Every Day in Every
Kind of a Metal Working Plant



"4-A" Polishing Compounds Are Faster, More Efficient, More Economical for Polishing, Mirror Finishing of All Kinds of Steel, Including Stainless Steel and Other Alloys.

Use it on any kind of a wheel, soft, hard, medium. Results will speak more eloquently than anything we could say.

Tell us about your toughest job, and we'll be glad to send the "4-A" product that will solve your problem. No obligation, of course.

CEMENT AND THINNER

Instead of glue, use "4-A" Cement and Thinner, a uniform substitute for polishing Wheels, Belts, Buffs, Rolls, etc.

Samples of Compound or Cement sent on request.

HARRISON & COMPANY
HAVERHILL, MASS.

accessory protective equipment, containing illustrations. The various parts and features of the helmets are separately described, and related items for the welder's safety are included, such as ear protectors, air line respirators and the "M.S.A. Explosimeter and Air-Mover." Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

Welding Spatter Compound. A folder containing information on "Spatter-Ex" and "Flash-Ex" compounds, both of which are soluble in water, and said to prevent the adhesion of spatter to either the part, dies or the welding holder jaws. Wayne Chemical Products Co., 9450 Copeland Ave., Detroit, Mich.

Wire Baskets. Rolock, Inc., 34 Station St. Southport, Conn., have issued a 12-page catalog describing wire mesh baskets for industrial use. Standard constructions and sizes of baskets for pickling, plating, heat treating and degreasing, are described.

New Books

A.S.T.M. Methods of Chemical Analysis of Metals. Published by the American Society for Testing Materials, Philadelphia, Pa. Size 9" x 6"; 250 pages. Price \$2.00 per copy in paper cover; \$2.50 in cloth binding.

This second edition (September 1939) of the volume on Methods of Chemical Analysis of Metals gives, in their latest approved form, all of the analytical procedures for ferrous and non-ferrous metals and spectrochemical analysis issued by the A.S.T.M. Four extensive standards cover ferrous metals, twelve apply to non-ferrous metals and alloys and three are spectrochemical methods.

Ferrous metals covered include steel, cast iron, open-hearth iron, wrought iron, ferroalloys (sampling, analysis, molybdenum salts).

Non-ferrous metals covered include

aluminum and light aluminum alloys, copper, brass ingots, manganese bronze, gun metal, bronze bearing metal, pig lead, lead, tin, antimony, copper, silver solders, nickel, slab zinc, and metallic materials for electrical heating.

Spectrochemical methods pertain to high grade pig lead, determination of lead, iron and cadmium in zinc, and minor constituents in zinc alloy die castings.

Wetting and Detergency. By W. Clayton. 2nd Edition 1939. Published by Chemical Publishing Co., New York. Size 5 1/4" x 8 3/4"; 207 pages. Price \$6.00.

This book is a compilation of the papers presented at a symposium held in London in February 1937, under the auspices of the British Section of the International Society of Leather Trades' Chemists.

It contains a foreword by Dr. W. Clayton. The book contains the papers, as well as interesting discussions, of many distinguished authors, such as Dr. H. Freundlich, N. K. Adam, E. K. Rideal and G. S. Hartley.

Some of the chapter headings are: Wetting and Deflocculation; Wetting Coefficients; Wetting-Out Agents; Measurement of Contact Angles by the Plate Method; Wetting of Pigments and Mechanism of Detergent Action.

The volume contains interesting theoretical aspects of the subject of wetting and detergency, but should be of considerable practical value to chemists able to understand the technical treatment of this subject.

Patent Fundamentals. By Adelbert Schapp. Published by the Industrial Press, New York City. Size 5 1/2" x 8 1/2"; 176 pages. Price \$2.00.

This is a textbook for inventors, executives, and students which explains in non-technical language and demonstrates by practical examples the underlying principles of true invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses, and, in brief, how to protect both invention and inventor.

Many inventors have failed because they did not receive the patent protection warranted by their inventions. The best and most approved ways of defining and protecting an invention are illustrated by numerous practical examples and thorough discussions of many important court decisions. By studying this material, the inventor or student should become a fair judge of patent claims. Engineers of all kinds, chemists and executives interested in inventions will find the information required for cooperating intelligently with patent attorneys in preparing and prosecuting patent applications. The chemist's problem is discussed, and there is an analysis of decisions relating to chemical patents.

This treatise includes information on trademarks and copyrights, design patents, prints and labels, and illustrates the different conditions under which these protective measures become available. It is written in textbook style, and is adapted for use in educational institutions having courses dealing with the fundamentals of patent law.

Mechanical World Year Book. 1940 Edition. Published by Emmott & Co., Ltd., 31 King St., W., Manchester, 3, England. Size 4¼" x 6¼"; 360 pages. Price 1s 6d.

This revision contains a new section on steam boilers with accompanying sections on boiler construction, mountings, fittings and instruments. Attention has been given particularly to war-time needs in selecting matter for the new edition. A new and separate index to the tables has been added to the material.

Journal of the Institute of Metals. Edited by S. C. Guillan. Volume LXIV, 1939. Published by Institute of Metals, London, S.W. 1, England. Size 8½" x 5½"; 428 pages. Price 3ls. 6d net.

The volume of the *Journal of the Institute of Metals* which has just been published is of even more interest and value than usual, since it contains full reports of two important discussions which took place at the general meeting of the Institute, held in March.

Of the two general discussions, the first concerned the effect of work on the mechanical properties of non-ferrous metals, which centered chiefly around a paper by that eminent metallurgist, Professor Sachs, entitled, "Some Observations on the Forging of Strong Aluminium Alloys". One of the contributions to the discussion was deemed of such importance that its author, Dr. L. Frommer, was asked to remold it in the form of a paper, and as such it now appears with the title "The Estimation of Cold Work from X-Ray Diffraction Patterns." It is illustrated by a unique series of X-ray photographs and expounds clearly a technique which is only just being developed, but which will in the near future undoubtedly become of first-class importance.

Letters From Our Readers

(Concluded from page 213)

and dissolved liquid substances; but also as much as 9% difference in hydrometer reading is brought about by continuous electrolysis of any aqueous solution, or even of pure distilled water. Thus a freshly prepared nickel chloride solution of 24.2 Be. may measure 26.6 Be., after a year's use without any change in its chemical constituency.

Leslie L. Linick.

On Hard Water for Plating

To the Editor,
METAL INDUSTRY.

I have read Mr. Clayton M. Hoff's letter published in the November 1939 issue of *METAL INDUSTRY*, entitled, "Water for Plating," in which he requests the ideas of readers.

During the past eight months, I have had the opportunity of observing plating solutions where hard water has been used

for many years. In one instance, hard water had been used for 17 consecutive years; in another, 37 years. In a plating room in a city in Illinois, 28 miles from the southern border of Wisconsin, the analysis of the water used was as follows:

Iron	trace
Manganese	0.15
Magnesium carbonate	47.10
Manganese oxide	0.15
Silicates	0.80
Calcium	80.50
Magnesium sulphate	75.20
SO ₄	6.86
Calcium carbonate	200.70
Chlorine	24.00
Ammonium sulphate	5.70
NO ₃	8.90
Sodium silicate	1.21

The chemist at the water department supplied me with a copy of the analysis and stated that there were that many parts

per million. The water is extremely hard, 26 grains hard, I was told by the manager of the factory where I was employed.

All water entering the boilers was softened by the use of Glaubers salt, and hot water supplied to the plating department after softening.

The brass plating solutions, of which there were nine; four 300-gallon tanks for still plating, and five 100-gallon tanks for barrel plating, all operated at elevated temperatures. I analyzed for carbonates and found that the amount ranged from 3.3 to 11 ozs./gal. Here are the results of the four still baths:

Tank No. 1	3.33 ozs./gal.
Tank No. 2	11.00 "
Tank No. 3	9.00 "
Tank No. 4	10.4 "

Barrel plating tank No. 1 10.33 ozs./gal.
Barrel plating tank No. 5 8.67 "

Tank Nos. 2, 3 and 4 at this writing,

PLATERS

Reduce Rejects—Save Money

IN CHROMIUM and nickel plating, for instance, high dependable performance has earned for Metso Cleaners top preference. Their thorough cleansing action removes drawing or stamping oils and other dirt from the metal surface or any entrapped in crevices.

Cleaned pieces show no water break and can receive direct chromium or nickel plate that stands the severest adherence test.

Put a Metso Cleaner to work in your plating department, for better results at a saving. Metso Cleaners are basic alkalis, sold at basic alkali prices, thereby effecting lower costs over a period of a year. Write Dept. FS.

Metso Cleaners Manufactured Exclusively by

PHILADELPHIA QUARTZ CO.

EST. 1831 General Offices and Laboratory: 125 S. Third St., Philadelphia, Pa.
Chicago Sales Office: 205 W. Wacker Drive. Metso stocks in 60 cities.
Sold in Canada by NATIONAL SILICATES LTD., Toronto, Ontario





WYANDOTTE likes big jobs! Whether it's a job of laundry production or a job of metal cleaning production, we're equipped to deliver results and keep the cleaning line moving.

Here's an example: A big laundry uses Wyandotte to wash 96 thousand pieces a day! That's 24 tons of work a day, 13 million pounds a year! A man-sized job, done by Wyandotte at minimum cost!

Just as the Wyandotte Laundry Service Representative solved this laundry's problem with a Wyandotte product, your local Wyandotte Industrial Representative can help you to determine which of the many Wyandotte metal cleaners will do your job best. Simply write to The J. B. Ford Sales Co., Wyandotte, Michigan.

Wyandotte

THE J. B. FORD SALES CO.

SERVICE REPRESENTATIVES IN 88 CITIES

WYANDOTTE MICH.

NEW SPARKLER

HORIZONTAL PLATE ACTIVATED CARBON AND FILTER AID FILTER

ENGINEERED FOR THE MODERN PLATING SOLUTIONS
(Bright Nickel, Cyanide Copper, Chromium, etc.)

Horizontal plates permit building up more uniform and thicker cake of carbon and filter aid assuring a sharper and more uniform result under all conditions. Horizontal cake is not disturbed by intermittent operation. Very economical to operate and simple to clean. No cloths or screens to wash. No waste of liquid being filtered.

Available in stainless steel, iron or rubber.

Write for free literature.

SPARKLER MFG. CO.

1214 Webster Ave.Chicago, Ill.

I cannot quote, having mislaid the paper on which it was written.

A carbonate remover was added to No. 4 still bath and the content was reduced from 10.4 ozs./gal. to 5.9 ozs./gal.

In a town in northern New York State on the St. Lawrence River, opposite the Canadian border, the analysis of the water used in the plating department was as follows:

Iron	0.03
Free ammonia	0.02
Ammonia albuminoid ..	0.112
Nitrites	0.002
Nitrates	0.1
Consumed oxygen	1.7
Chlorides	13.0
Total hardness	116.0
Alkalinity	86.0
pH Value	8.3

Total hardness is 6.784 grains per U. S. gallon.

In this plating room, there were five 300-gallon still brass plating tanks, and the carbonate content of Nos. 1, 2, 3, 4 and 5 were respectively: 3.08; 2.71; 2.76; 3.61 and 3.60 ounces per gallon.

The six 100-gallon barrel plating brass tanks contained carbonates as follows: No. 1—9.44; No. 2—9.97; No. 3—4.88; No. 4—7.58; No. 5—10.35 and No. 6—9.75 ounces per gallon.

Why the carbonates in the still baths at this factory are lower than the amounts in the barrel tanks, I am unable to explain at this writing.

The white precipitates in these 20 tanks of brass solution were from 3 to 4 inches in depth.

The type of work plated in both of the above-mentioned factories is identical; all made of steel. I am now making observations in a Canadian factory of hard water used in the plating room where identical parts are made as in the two factories in the United States. Water in the New York or Canadian factories is not softened.

I agree with Mr. Hoff in his assertion that while the quality of plating chemicals has increased, the impurities introduced into the plating bath from the water supply are much greater.

Very truly yours,
Royal F. Clark, Sr.
Prescott, Ont., Can.

Associations and Societies

Boston Branch

The Boston Branch will hold its annual educational session and banquet at the Statler Hotel, Boston, Saturday, April 13th.

The speakers at the educational session, which starts at 2:00 P.M., are:

Robert Sizelove, Frederick Gumm Chemical Co., "Trouble Shooting".

Myron B. Diggin, Hanson-Van Winkle-Munning Co., "Ductile Nickel Deposits and Semi-Bright Nickel Bath".

E. C. Rinker, Oakite Products, Inc.



Joseph Barron of M. E. Baker & Co., Cambridge, Mass. In charge of program of Boston Educational Session.

"Metal Cleaning Before Plating".

N. E. Promisel, International Silver Co., "Anodic Polishing".

Registration, \$2.50; tickets can be secured from A. W. Garrett, 100 King St., Dorchester, Mass.

New York and Newark Branches

The second annual joint educational session and jamboree will be held at the Hotel Douglas, Newark, N. J., March 30.

The educational session will start at 2:30 P.M., with the following speakers:

O. A. Mockridge, Johns-Manville Co., N. Y., will present a motion picture, "The Story of the Diatom".

G. B. Hogaboom, Hanson-Van Winkle-Manning Co., Matawan, N. J., "Research".

R. O. Hull, E. I. duPont de Nemours & Co., Cleveland, Ohio, "Current Density Range Characteristics—Their Measurement and Application".

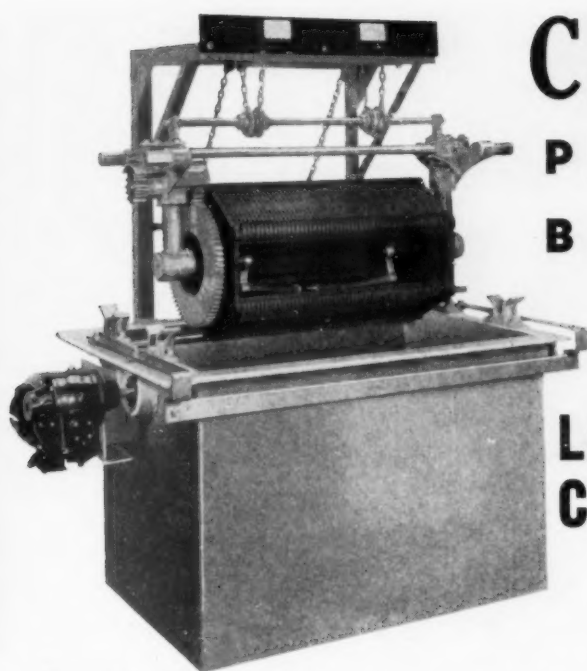
Dr. C. B. F. Young, Institute of Electrochemistry and Metallurgy, "A Curriculum for the Practical Electroplaters".

Dr. A. Kenneth Graham, A. Kenneth Graham & Associates, Jenkintown, Pa., "Studies of Electrolyte Films".

In the afternoon, the ladies will be entertained by the Ladies' Auxiliary of the Newark Branch. The usual dinner will not be held, and instead, the jamboree will start at 8:30 and will consist of dancing and entertainment with soft drinks served all evening, and a buffet lunch served from 10 P.M. until midnight.

Rochester Branch

The Rochester Branch will hold its 20th annual educational session and dinner dance at the Hotel Seneca, Rochester, N. Y., on Saturday, April 27.



CROWN PLATING BARREL

HAS NEW
TYPE

LAMINATED CYLINDER

with slot
openings

THIS NEW Crown plating cylinder is made of molded rubber sections rigidly held by steel support ribs on 4-inch centers.

Advantages of this new design include promotion of circulation due to the slotted openings, ability to replace worn sections with new ones and the fact that the rubber sections resist attack by chemicals. For complete details write to—

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Complete Plating and
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TRADE MARK

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Yes, Sample Free

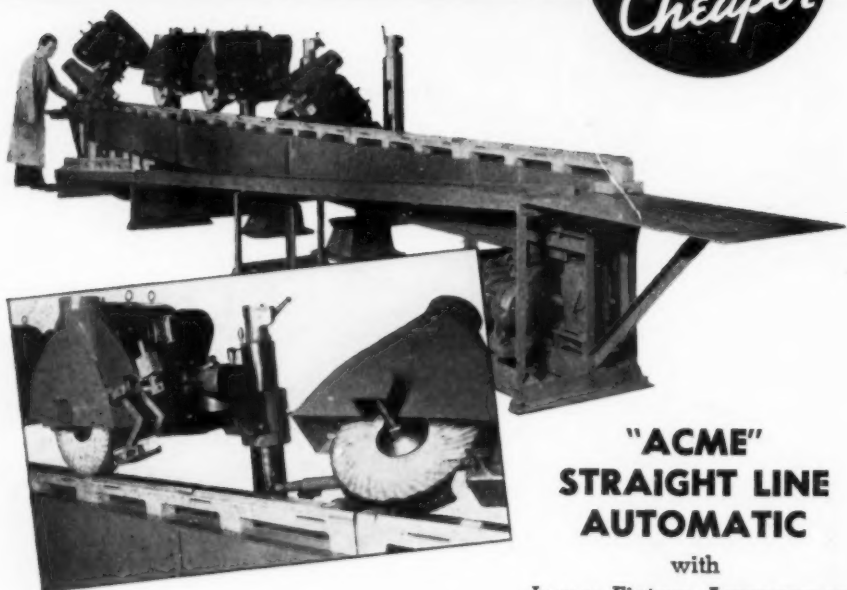
SULPHUR PRODUCTS CO.

Greensburg, Pa.

(Let's Fly to Dayton—A.E.S. Convention, June 10, 11, 12, 13)

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*Faster
and
Cheaper*



**"ACME"
STRAIGHT LINE
AUTOMATIC**

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Estimate**

With individual polishing and buffing heads set at any desired angle in relation to the work, the Acme set-up above illustrated produces a phenomenal increase in the production rate and a phenomenal decrease in the cost per piece of polishing and buffing such articles as mouldings, die-cast grilles, hardware, center bars and other parts with similar characteristics.

Other types of Acme Automatics achieve the same results in the polishing and buffing of parts of widely different character. If you are interested in time-saving, money-saving, or in giving your product a better finish, investigate what an Acme Automatic will do for you.

ACME Manufacturing Co.
1642 HOWARD ST. • DETROIT, MICH.
Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS

The educational session will start at 1:00 P.M., with the following speakers:
Frank Henry, Chemist, Rochester Gas & Electric Corp., "Water".

D. A. Cotton, Chief Chemist, Delco-Remy Div., General Motors Co., Anderson, Ind., "Chromium Plating Dies and Gauges".

Raymond F. Yates, Vice-President, Krome Alume Corp., "Plating of Aluminum and Its Alloys According to the Krome-Alume Process".

Tickets are \$2.50 per person, which can be obtained by writing to *Judson R. Elster*, 176½ Fulton Ave., Rochester, N. Y.

New England Branches

Bridgeport, Hartford, New Haven, Springfield and Waterbury

The second educational session and banquet will be held at the Elton Hotel,

Waterbury, Conn., on Saturday, April 27th.

The educational session will start at 2:30, with the following speakers:

Clarence Van Derau, past supreme president of the A.E.S.; works manager, Westinghouse Co., Mansfield, Ohio.

T. H. Chamberlain, supervisor of Production, Chase Brass & Copper Co., Waterbury, Conn., "Finishing of Copper and Copper Alloys."

A. B. Wilson, past supreme president of the A.E.S.; Chevrolet Motor Co., Detroit, Mich., "Bumper and Anode Manufacture of the Chevrolet". Plant illustrated.

The banquet will be held at 7:00.

Tickets are \$2.50. *Ellsworth Candee*, American Brass Co., Waterbury, Conn., general chairman.

Bridgeport Branch

The speaker at the March meeting was

Sam Tour, vice-president of *Lucius Pitkin, Inc.*, New York, who spoke on "Chemical Means of Polishing Metals". A history of electrolytic polishing was presented followed by discussions of treatments available for various metals, such as stainless steel, aluminum and brass.

Detroit Branch

Prof. Wm. B. Gertz, Michigan School of Mining and Technology, Houghton, Mich., will address the Branch on May 3rd, the subject of his talk being, "The Relationship and Effects of Education on our Plating Industry".

Los Angeles Branch

A talk on occupational health hazards in the electroplating industry by *Dr. J. P. Russell*, Chief of Industrial Hygiene Service, California Department of Public Health, featured the March 13 meeting of Los Angeles Branch.

Dr. Russell prefaced his talk with an account of progress being made toward eliminating occupational health hazards in American industry. He then discussed various health hazards peculiar to the electroplating business, stressing the dangers of shop workers contracting silicosis from silicate-laden air unless such hazard is minimized by isolating dust-producing operations and using proper exhaust ventilating hoods in grinding and polishing work. The dangers to workmen in inadequately equipped plants from acid fumes at pickling tanks, solvent vapors and chemical poisoning were also touched upon, as well as nickel itch, chromium poisoning and related subjects.

President *Ray Bray* presided. Elected to associate membership were *George A. Otter*, Los Angeles Department of Power and Water, and *Rockford J. ("Rock") Chartrand* of the L. H. Butcher Co., Los Angeles office.

The chapter accepted with thanks an engraved testimonial from the Newark Branch, which expressed appreciation for Los Angeles Chapter's assistance at the 27th annual convention at Asbury Park, N. J., June 19 to 22, 1939.

Final reports were made by *M. D. Rynkofs* and *Don Bedwell* of the committee arranging the annual educational session. *Mr. Rynkofs* reported the management of the Hollywood Roosevelt Hotel had spent \$10,000 re-decorating the Blossom Room along Hawaiian lines and that the local A.E.S. Chapter would be the first organization privileged to make use of the re-furnished meeting room. *Mr. Bedwell* reported that for the first time in the annals of the A.E.S. anywhere, a complete recording of every speech as well as questions and answers, and open forum discussion had been arranged for the annual educational session. Two recording machines were to be provided, he announced, for making a complete record of everything which transpires. The records will remain the official property of Los Angeles Branch, but will undoubtedly be made available to other chapters.

Secretary *Ray Solivan* announced that

the annual election of chapter officers will take place at the April meeting at Hotel Rosslyn.

American Foundrymen's Association

The 44th annual convention will be held from Monday, May 6 to Friday, May 10. The Foundry Show will open on Saturday, May 4th.

The feature of the convention will be the annual Board of Awards address, the lecture being given by *Charles E. Wilson*, Executive Vice-President of the General Motors Corp., Detroit, Mich.

A complete technical program on both ferrous and non-ferrous foundry problems has been arranged, and a copy of this program may be secured by writing the secretary of the Association, *C. E. Hoyt*, 222 W. Adams St., Chicago, Ill.

The Plating and Rustproofing Association of Michigan elected *Charles H. Nehls*, president of Wayne Metalcraft Corp., Detroit, to the Board of Directors and the officers of 1939 were re-elected for 1940.

W. R. Knight, president of the Knight Plating Company, Detroit, was elected president, and *R. L. Reed*, president of the Robert L. Reed Plating Company, Detroit, was elected vice-president, and *Fredrick R. Bolton* was elected for the third year as Secretary-Treasurer.

The Association has been active during the past year in cooperation with labor, continuing its credit bureau work and of establishing contacts with the manufacturing industry.

James W. Higgins of the Packard Motor Car Company, was elected an honorary member of the Association.

Personals

Dr. Ernest D. Wilson Appointed Department Head at Worcester Polytechnic Institute

Dr. Ernest D. Wilson, president of the Zialite Corp., 117 N. Second Ave., Mt. Vernon, N. Y., manufacturers of electroplating solutions, has been appointed head of the Department of Chemical Engineering and Chemistry of Worcester Polytechnic Institute, having assumed his new duties on March 1st.

The Institute has recently remodeled its chemistry building, adding a new lecture hall and a chemical engineering laboratory.

Dr. Wilson received his B.Sc. degree from the University of Nebraska in 1913 and his Ph.D. from the University of Chicago in 1915. He has been a research associate in physical chemistry at the Mass. Institute of Tech., and a Fellow at Mellon Institute. He has been associated in industrial work from 1919 to date, with the following companies: Graton & Knight Mfg. Co., Worcester, Mass., American Cyanamid Co., Barsky & Wilson, consultants, New York; Zialite Corp., New York, president.

Dr. Wilson is a member of various so-

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Recognized as the world's largest manufacturer of chromium chemicals, Mutual brings to the plating industry a basic source of chromic acid.

Our facilities cover every step in its production, from the mining of the chrome ore on a remote island in the Pacific to the wide distribution of the finished product through warehouse stocks in the principal consuming centers.



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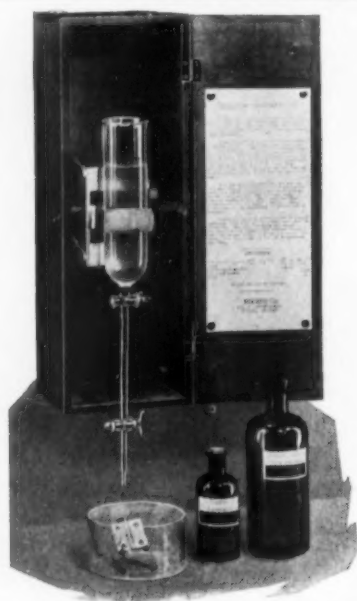
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A rapid reliable method for determining thickness of deposit.

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CHICAGO

for Better plated surfaces

Prepare for a fine plate first by burnishing small, metal parts. After plating, burnish again. That rolls down the surface, closes pores, increases resistance to corrosion. Pressure does the job. Therein lies the advantage of Abbott high, narrow barrels which take a charge of several hundred pounds of steel burnishing materials. This mobile weight, confined within an upright area, develops maximum pressure on the work. Questions gladly answered. Orders promptly filled.



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A NEW NICKEL STRIPPING PROCESS

(Patent applied for)

SAVES TIME

Saves up to 50 per cent in stripping time.

PROTECTS THE BASE METAL

Strips nickel from steel, brass and zinc die castings without pitting or roughening the base metal.

SAVES ACID

More dilute Sulphuric Acid solutions can be used.

SAVES MONEY

Reduces finishing costs.
Shortens stripping time.
Requires less acid.

Write for information and prices.

CHEMICAL CORPORATION

93 Broad Street

Springfield, Massachusetts

cieties including Sigma Xi, Gamma Alpha, Alpha Chi Sigma, American Chemical Society, American Institute of Chemical Engineers, Electrochemical Society, and American Electroplaters' Society, and is a member of the Chemists' Club, New York. He will continue his interest in the Zialite Corporation, as an active consultant and the company will eventually be moved to Worcester, Mass.

Battelle Memorial Institute has announced the appointment to its staff of *Robert H. Heyer*, American Society for Testing Materials Dudley Medalist in 1938, and author of the recently-published "Engineering Physical Metallurgy."

Mr. Heyer holds B.S. and M.S. degrees from the University of Minnesota. He was formerly a research metallurgist with American Rolling Mill Company, and previous to that a member of the faculty at Purdue University.

His society affiliations include American Society for Metals, and American Institute of Mining and Metallurgical Engineers.

Business Items

United States Stoneware Company Celebrates 75th Anniversary

The United States Stoneware Company, 60 East 42nd Street, New York, N. Y., factory at Tallmadge, Ohio, will celebrate, in April, its 75th anniversary, being incorporated in the year 1865. The original factory consisted of one small kiln producing simple items and employing just three men. Today, the company possesses one of the most modern plants in the industry, with well organized research and engineering departments, manufacturing a complete line of ceramics and corrosion-proof chemical equipment.

Some of the workmen have been with the company over 48 years, and in one department, a father, son and grandson are working side by side.

A new machine shop building is now being erected to house the company's machine manufacturing division, for use in the fabrication and assembly of centrifugal acid pumps, exhausters, mixers, jar mills, etching machines, etc., and another new building is also in the course of construction to be used for the manufacture of tank lining materials.

William B. Lawson, formerly of The Harshaw Chemical Company and The International Nickel Company, announces the formation of *W. B. Lawson, Inc.* dealing in industrial chemicals, oils, and non-ferrous metals. Offices are in the Union Commerce Building, Cleveland, Ohio.

Mr. Lawson joined the Harshaw organization in 1930 and resigned on January 25th, this year. Previous to joining that company Mr. Lawson was for many years with The International Nickel Company holding various executive positions. When he resigned from International in 1930 he was Director of Sales, which position he had held for several years.

According to Mr. Lawson, President, the new company offers a personalized buying and selling service based on his years' of experience, his broad contacts in chemical and metal trades and a highly specialized knowledge of many markets.

H. Kramer & Co., Chicago, Ill., smelters and refiners of ingot bronze and brass alloys, have announced that D. M. Curry is now affiliated with them as a member of their Technical Service Staff. Mr. Curry recently resigned from the Development and Research Dept. of the International Nickel Company, New York, with whom he was connected for five years. Prior to that time, he was foundry superintendent for seven years, of the Federal-Mogul Corp., Detroit, and previously was connected with the Ford Motor Co., Detroit, for eleven years as assistant foundry superintendent. Mr. Curry is widely and favorably known among non-ferrous foundries throughout the United States as a result of his extended experience and constructive achievements. His services are available to brass foundries on any subject pertaining to practice and operation, with the view of assisting them in the solution of their problems.

Elastic Stop Nut Corp., Elizabeth, N. J., have recently broken ground for a new plant on Vauxhall Rd., Union, N. J. The plant will be used solely for the manufacture of the corporation's line of self-locking nuts. It is laid out for the most efficient handling of materials and fabrication of the product, with provision for expansion as future needs may require. Transfer from the present plant will be made about June first.

Williamsville Buff Mfg. Co., Danielson, Conn., announces the appointment of A. H. Embler and W. P. Darraugh of 12709 Stoepel Ave., as sales representatives in the Detroit area.

Because the war in Europe has caused shifting in the sources of supply for raw materials of many nations, the American Nickeloid Company, Peru, Illinois, has found increased demand for its pre-finished metals in many foreign markets, and to better serve this business, announces the establishment of an export office at 201 North Wells Street, Chicago. Sales representatives are being established in all principal countries abroad.

Colonel A. L. Mercer, president and H. L. Trembicki, manager of the Metal Cleaning Dept., of the Cowles Detergent Co., 10525 Carnegie Ave., Cleveland, Ohio, are pleased to announce the appointment of the Apex Soap & Sanitary Corp., 1118 Island Ave., McKees Rocks, Pa., as distributors of Cowles anhydrous metal cleaners. The Apex Soap & Sanitary Corp. will maintain a complete stock of Cowles cleaners in their McKees Rocks warehouse and will ship to all points in Western Penna., Northern W. Va., and Eastern Ohio.



What is most needed in electro cleaning is speedy wetting action, rapid penetration and effective dispersing effect, followed by thorough drainage of the solution and easy, quick rinsing.

These are the features which characterize Magnus Electrex Cleaners. Drag-over will not cause difficulties or form troublesome films or scums. Electrex Cleaners are all acid and hardwater proof.

Cut your costs and improve your results in electro cleaning. Try Electrex Cleaners and see the improvement they give.

GET THIS NEW BULLETIN

It covers the Magnus Electrex line completely and the results you can get on die-cast and soft metals—on brass—on steel, and on steel-brass combinations.

MAGNUS CHEMICAL COMPANY

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Garwood, N. J.



MAGNUS CLEANERS

1940 PLATING and FINISHING GUIDEBOOK

The 1940 Plating and Finishing Guidebook will be mailed April 30th to subscribers of Metal Industry. This edition has been completely revised and new sections have been added on plating and finishing. In addition, a section on organic finishing has been included.

There are 2 WAYS to buy ADVERTISING SPACE

1 *The*
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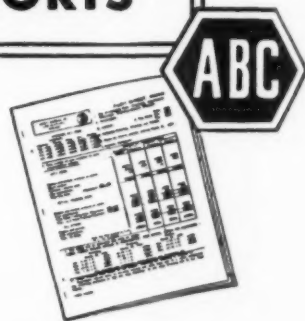
TIME was when buying advertising space seemed like groping in the dark. With no facts to serve as guide through the mysteries of circulation, you had to rely on rumor and hearsay. You had to pick your papers by guess-work . . . and hope for the best results as far as sales were concerned.

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The **METAL INDUSTRY**

**An A. B. C.
Publication**

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Supply Prices, March 29, 1940

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

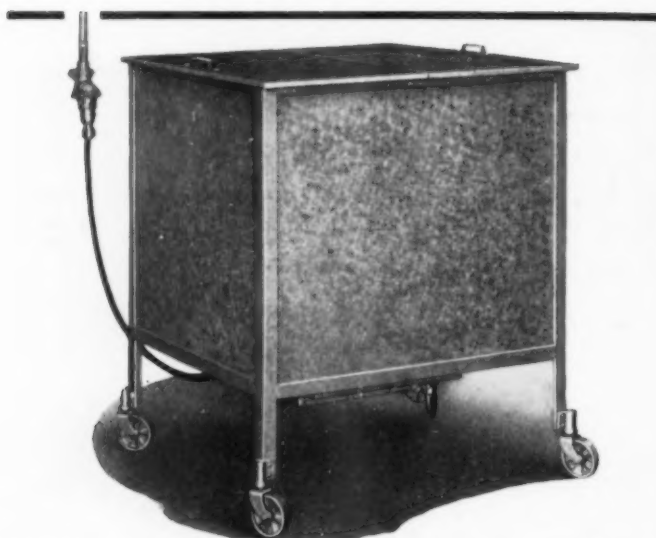
COPPER: Cast	21½c. per lb.	NICKEL: 90-92%, 16" and over	.45 per lb.
Electrolytic, full size, 16½c.; cut to size	16½c. per lb.	95-97%, 16" " "	.46 per lb.
Rolled oval, straight, 17½c.; curved	18½c. per lb.	99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48c.	
BRASS: Cast	19¼c. per lb.	SILVER: Rolled silver anodes .999 fine were quoted from 38c. per Troy ounce upward, depending on quantity.	
ZINC: Cast	11 c. per lb.		

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, Pure, l.c.l., drums	lb.	.08	Gum, Arabic, white, powder, bbls.	lb.	125-14
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059	Sandarac, prime, bags	lb.	50
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16½-.17¼	Hydrogen Peroxide, 100 volume, carboys	lb.	20
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027	Iron Sulphate (Copperas), bbls.	lb.	.017
Hydrochloric, C.P., 20°, carboys	lb.	.08	Lead, Acetate (Sugar of Lead), bbls.	lb.	.11-.13½
Hydrofluoric, 30%, bbls.	lb.	.07-.08	Oxide (Litharge), bbls.	lb.	.125
Nitric, 36°, carboys	lb.	.06	Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Nitric, 42°, carboys	lb.	.075	Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Oleic (Red Oil), distilled, drums	lb.	.09-.10	Mercuric Oxide, red, powder, drums	lb.	\$3.06
Oxalic, bbls. l.c.l.	lb.	.12-.14	Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Stearic, double pressed, distilled, bags	lb.	.11¼-.12¼	Chloride, bbls.	lb.	.18-.22
single pressed, distilled, bags	lb.	.10¼-.11¼	Salts, single, 425 lb. bbls.	lb.	.135-.145
triple pressed, distilled, bags	lb.	.14-.15	Salts, double, 425 lb. bbls.	lb.	.135-.145
Sulphuric, 66°, carboys	lb.	.025	Paraffin	lb.	.05-.06
Alcohol, Amyl, (Fusel oil, ref'd), l.c.l., drums	lb.	.175	Perchloroethylene, drums	lb.	.08¼
Butyl-normal, l.c.l., drums	lb.	.095	Phosphorus, red, cases	lb.	.42
Denat., S.D. #1, 190 pf., 1-18 drms, wks.	gal.	.335	yellow, cases	lb.	.40
Diacetone, pure, drums, l.c.l.	lb.	.11	Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Methyl, (Methanol), 95%, drums, l.c.l. gal.	gal.	.355-.38	Potassium, Bichromate, crystals, casks	lb.	.09¼
Propyl-Iso, 99%, l.c.l., drums	gal.	.41	Carbonate (potash) 98-100%, drums	lb.	.06¼
Propyl-Normal, drums	gal.	.70	Cyanide, 94-96%, cases	lb.	scarce
Alum, ammonia, granular, bbls., works	lb.	.035	Pumice, ground, bbls.	lb.	.03
Potash, granular, bbls., works	lb.	.0375	Quartz, powdered	ton	\$30.00
Ammonia, aqua, 26°, drums, carboys	lb.	.02½-.05¼	Quicksilver (Mercury) 76 lb. flasks	flask	\$90.00
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.0521-.075	Rochelle Salts, crystals, bbls.	lb.	.24¼
Sulphate, tech., bbls.	lb.	.035-.05	Rosin, gum, bbls.	lb.	5.25-7.75
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	scarce	*Silver, Chloride, dry, 100 oz. lots	oz.	.32
Sulphocyanide (thiocyanate), com'l, drums	lb.	"	Cyanide, 100 oz. lots	oz.	.33¼
Antimony Chloride (butter of antimony), sol., carboys	lb.	.13	Nitrate, 100 oz. lots	oz.	.27
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03	Sodium, Carbonate (soda ash), 58%, bbls.	lb.	.0235
Benzene (Benzol), pure, drums, works	gal.	.21	Cyanide 96%, 100 lb. drums	lb.	.15
Butyl Lactate, drums	lb.	.235	Hydroxide (caustic soda) 76%, flake	lb.	.0355
Cadmium Oxide, l.c.l., bbls	lb.	.85	Hyposulphite, crystals, bbls.	lb.	.035-.065
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05½-.075	Metasilicate, granular, bbls.	lb.	.0335
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05½-.06	Nitrate, tech., bbls.	lb.	.029
Carbon Tetrachloride, l.c.l., drums	gal.	.73	Phosphate, tribasic, tech., bbls.	lb.	.0295
Chrome, green, commercial, bbls.	lb.	.22	Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.0580
Chromic Sulphate, drums	lb.	.26¼	Sesquisilicate, drums	lb.	.0425
Cobalt Sulphate, drums	lb.	.65	*Stannate, drums	lb.	.32-.34
*Copper, Acetate (verdigris), bbls.	lb.	.25	Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Carbonate, 53/55%, bbls.	lb.	.16¼-.17¼	Sulphocyanide, drums	lb.	.30-.35
Cyanide, Tech., 100 lb. bbls.	lb.	.34	Sulphur, Flowers, bbls., works	lb.	.037-.0410
Sulphate, Tech., crystals, bbls.	lb.	.051	*Tin Chloride, 100 lb. kegs	lb.	.37
Cream of Tartar (potassium bitartrate), gran., kegs	lb.	.27¼	Toluene (Toluol), pure, drums, works	gal.	.30
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07	Trichlorethylene, drums	lb.	.08¼
Dibutyl Phthalate, l.c.l., drums	lb.	.195	Tripoli, powdered	lb.	.03
Diethylene Glycol, l.c.l., drums, works	lb.	.155	Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.38-40
Dextrine, yellow, kegs	lb.	.05-.08	Bees, yellow, crude	lb.	.28-29
Emery Flour (Turkish)	lb.	.07	Carnauba, refined, bags	lb.	.55-59
Ethyl Acetate, 85%, l.c.l., drums	lb.	.075-.08	Montan, bags	lb.	.26-30
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20	Spermaceti, blocks	lb.	.26-27
Flint, powdered	ton	30.00	Whiting, Bolted	lb.	.025-.06
Fluorspar No. 1 ground, 97-98%	ton	\$60.00	Xylene (Xylol), drums, works	gal.	.32
Fusel Oil, refined, drums	lb.	.125-.14	Zinc, carbonate, bbls.	lb.	.17
*Gold, Chloride	oz.	\$18¼-.23	Cyanide, 100 lb. kegs	lb.	.33
Cyanide, potassium 41%	oz.	\$15.45	Chloride, granular, drums	lb.	.06
Cyanide, sodium 46%	oz.	\$17.10	Sulphate, crystals, bbls.	lb.	.04

*Subject to fluctuations in metal prices.



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APRIL, 1940

ORGANIC FINISHING

SECTION OF METAL INDUSTRY



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ORGANIC FINISHING

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APRIL, 1940

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Color, Organic Finishes and Sales

The day of the ultra-conservative manufacturer who was willing to consider any color for his product as long as it was black is gone. Color is becoming increasingly important in merchandising and for good reason. We all possess definite reactions to color, just as we have reactions to smell and sound, and it has been found that a powerful urge to buy can be created by appealing to our color likes and dislikes.

A large part of the present swing to color has been due to the efforts of the manufacturers of organic finishing materials. They have realized the importance and possibilities of color in selling, and knowing that one of the most widely employed media for color is the organic finish, they have formulated lacquers, paints and enamels for every conceivable color purpose. In addition, they have undertaken to help their customers in the selection of effective colors and color combinations for their products by establishing styling service departments where problems in sales appeal are solved.

The manufacturers of organic finishing materials are to be commended for their contribution to better merchandising and for their ability to recognize the possibilities of their own products.

On page 244 is a report of color likes and dislikes throughout the United States for automobile finishes. This report shows that there are definite variations throughout different parts of the country on the favorite colors of organic finishes, at least, for automobiles.

Calculation of Finishing Material Costs

By Willoughby G. Sheane

Chemical Engineer
General Electric Co.,
Bridgeport, Conn.

I. Mileage Per Gallon

$$M = \frac{(W) (Ps)}{(Dc) (Tc) (519)}$$

M—mileage per reduced (ready to apply) gallon of finishing material—square feet

W—weight per gallon of reduced finishing material—pounds

This datum is most easily obtained with an hydrometer. The specific gravity reading multiplied by 8.33 gives the weight per gallon in pounds.

Ps—per cent by weight of non-volatile solids in reduced finishing material

Carefully weigh a small sample of the reduced finishing material into a tared weighing dish and dry to constant weight at about 100°F. The weight of the dried sample divided by the weight of the original sample and multiplied by 100 gives the per cent by weight of non-volatile solids.

Dc—density of the cured film of finishing material

Accurately weigh and measure the area and thickness of a clean, flat panel. Apply a uniform coat of the finishing material to one side of the panel and, in the case of a baking material, bake for the regular schedule, or, in the case of an air drying material, dry to constant weight. Accurately weigh and measure the thickness of the finished panel.

The density of the cured film is calculated from the following equation:

$$Dc = \frac{(w)}{(a) (t) (16.39)}$$

The author herewith presents formulae for calculating mileage per gallon, density of cured film and cost of finishing material per gallon. The calculations do not, of course, include overspray or other losses but are based on 100% utilization. The calculations, however, permit the obtaining of relative costs of finishing material coverage and the actual cost for several materials if actual cost data are available for one finishing material.—Ed.

w—weight of cured film (by difference)—grams

a—area of panel—square inches

t—thickness of cured film (by difference)—grams

16.39—constant

Tc—thickness of cured film of finishing material which is acceptable for protection and/or decoration—inches

519—constant

Example

An organic finishing material costing \$2.00 per gallon (Cp) required a 20.00 per cent by volume reduction (Pt) with a reducer costing \$0.85 per gallon (Ct). In this reduced form the material weighed 6.5 pounds per gallon (W) and contained 35.0 per cent by weight of non-volatile solids (Ps). The cured film thickness acceptable for protection and decoration was 0.0013 inches (Tc).

A uniform coat of the reduced finishing material was applied to a clean, flat panel measuring 48 square inches in area (a). The coated panel was then cured. The bare panel measured 0.0469 inches in thickness and weighed 230.15 grams. The finished panel measured 0.0521 inches in thickness and weighed 234.33 grams.

Substituting the above data in the given equations:

$$Dc = \frac{(234.33-230.15)}{(48) (0.0521-0.0469) (16.39)} = 1.025$$

$$M = \frac{(6.5) (35.0)}{(1.025) (0.0013) (519)} = 329 \text{ sq. ft./gal.}$$

$$C = \frac{(20.0) (0.85) + (100-20.0) (2.00)}{100} = \$1.77/\text{gal.}$$

II. Cost Per Gallon

$$C = \frac{(Pt) (Ct) + (100-Pt) (Cp)}{100}$$

C—cost per reduced gallon of finishing material—dollars

Pt—per cent by volume of added reducer in reduced finishing material

Ct—cost per gallon of reducer—dollars

Cp—cost per gallon of unreduced finishing material—dollars

Whence, the material cost per square foot finished =

$$\frac{C}{M} = \frac{1.77}{329} = \$0.00538$$

The final calculated material cost per square foot finished, as obtained above, is an absolute figure and does not account for overspray losses, uneven films, etc. It is based on 100% utilization, that is, no material waste and the application of an absolutely uniform film. However, the relative costs of two finishing materials may be obtained from a comparison of the

calculated costs. For example, if the calculated cost of material A is \$0.0080 per square foot finished and that of material B is \$0.0040, then material A is twice as expensive as material B.

Furthermore, if the actual cost and the calculated cost of a material are both known, then the actual cost of any other material whose cost has been cal-

culated is indicated by direct ratio. For example, if the actual cost of material A above is \$0.0120 per square foot finished, then the actual cost of material B will be \$0.0060 per square foot finished. In this manner the actual cost for any finishing material may be obtained without the necessity for conducting time-consuming production tests.

Directions For Use

Using the data set forth in the lower left hand corner of the chart, for example, the mileage is found as follows:

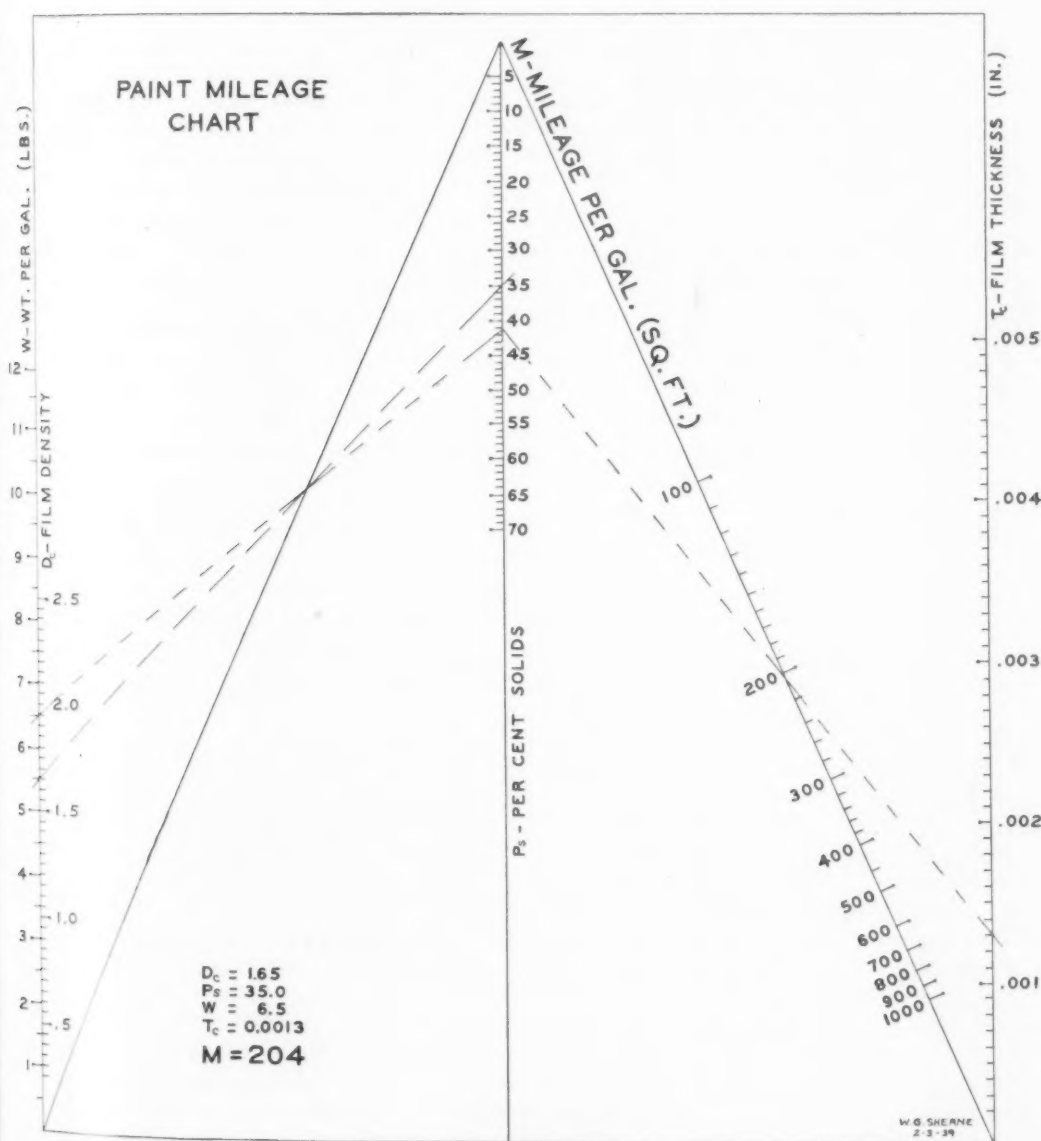
(1) Draw a straight line connecting the values of D_c (1.65) and P_s (35.0). This line will intersect the sloping line located to the left of the vertical center line.

(2) From the value of W (6.5) extend a straight line through the intersection obtained in Step (1) until it intersects the vertical center line.

(3) Draw a straight line connecting the value of T_c (0.0013) and the intersection obtained in Step (2). This line will intersect the mileage scale at the mileage value of M (204 square feet per gallon) for the material under consideration.

CHART FOR CALCULATING PAINT MILEAGE

Paint mileage may be quickly and easily determined from the following chart, without the necessity for mathematical calculations:



Moisture Peeling of House Paints*

EFFECT OF STRUCTURAL DETAILS

J. W. Iliff and R. B. Davis

E. I. du Pont de Nemours & Company, Inc., Philadelphia, Penna.

The failure of paints, due to moisture, has been recognized for many years. The first serious consideration of the problem was given by F. L. Browne of the Forest Products Laboratory prior to 1927¹. Subsequently, however, Hartwig examined over fifteen hundred houses and published his conclusions on the subject². His survey is generally recognized as the classic reference relative to this problem. Numerous papers have appeared since that time, but it is felt that the paint industry still does not appreciate the threat that this type of failure offers to a large proportion of its sales. The construction of frame houses has been challenged by a number of builders on this account.

Much of this failure affects only a small portion of the individual house area. Nevertheless, the house owner is often obliged to repaint the whole house to take care of the small area which has failed in each instance.

The most generally accepted method of testing outside house paint has been test fence exposure. About ten years ago, it was recognized by our laboratory that a serious discrepancy existed between paint performance on test panels and on houses. Accordingly an extensive house test program was undertaken which has included over four hundred and fifty houses. These are located in the Philadelphia and New York metropolitan areas, New Jersey seashore, Boston, Chicago, St. Louis, Texas panhandle, Houston, Atlanta, Miami, Flint, Mich., and Louviers, Colo.

The houses included in the test program had previously been painted with a wide variety of materials. The data on moisture peeling shown here

*Reprinted from Ind. & Eng. Chem., Nov. 1939

House paint failure due to moisture is increasing to an alarming extent, especially in certain sections of the country. A testing method for moisture failure is described. A heated humidified building, thermostatically controlled, is used; however, it is effective only in cold weather. It is equipped so that test fence panels may be further tested over certain structural variables. The method of recording and interpreting results is described.

It is concluded that tar paper has only a limited favorable effect in the prevention of moisture failure, the blocking of air circulation behind the painted areas has an adverse effect, within certain limitations the sealing of the interior moisture from the exterior painted surfaces has a favorable effect, and the introduction of exterior air behind the painted areas has a very favorable effect.

are based on the condition of the houses prior to the application of the test paints. Sufficient data were available on approximately one hundred of these houses to permit an analysis of the condition of paint from the standpoint of moisture failure.

In conducting this analysis, each side of the house was considered as a separate test. Moisture failure was listed as present if 3 or more square inches of surface were affected. The results of this analysis are shown in Figure 1. Moisture failure is much more common in the colder and damper climates than in the warmer and drier climates. The startling observation is noted that over 50 per cent of the tests in the most densely populated part of the United States (northeastern) are showing failure. Obviously, 3 square inches of failure due to moisture is not a serious problem to the house owner so long as it does

not progress further. Therefore, the percentage of houses showing moisture failure subject to complaint is less than 50 per cent. This figure is, however, of real significance to the paint technician, especially if it should be confirmed by a more comprehensive survey.

It was observed that moisture failure almost always started with a loss of adhesion during the winter months, although in many cases actual peeling was delayed until the film hardened during the summer.

Moisture which is responsible for paint failure may reach the wood in one of two ways. The first is that ordinarily associated with careless construction—liquid water dropping onto the wood from leaks in the external surface. The second is in vapor form due to moisture migrating from the



Figure 1. Percentage of visible moisture failure.

warm interior of the house to condense against the cold exterior portion of the wall or the clapboards. The conclusion that moisture does migrate under such conditions was confirmed



Figure 2. Test house, and Figure 3, Stripped exterior section.

by a simple laboratory experiment.

The first source is well recognized in the industry and was treated in detail in Hartwig's paper. The second source, however, is the more important of the two, particularly in modern construction, and yet is least appreciated. It was to study largely the effect of this source of moisture that the problem was undertaken and the present apparatus was constructed.

Testing Method

The design for the apparatus obviously should duplicate the conditions under which houses are operated. It should also be so constructed as to permit test fence panels to be removed from the exposure racks and tested for moisture failure as a part of their testing program.

The apparatus consists of a small building 5 feet wide, 7 feet high, and 28 feet long, located on the roof of a building in Philadelphia (Figure 2). The ceiling, floor, and both ends of the building are insulated. The sides, however, are constructed of studs placed at 18-inch intervals. Test panels may be attached to the outside (Figure 3) and the interior construction may be varied in accordance with testing needs. The operation of the apparatus has been combined with that of the ordinary exposure stations. The panels used are usually exposed on the test fences for a period of from 3 months to 2 years before they are placed on the apparatus.

For most of the testing work, galvanized

iron sheets as shown in Figure 3 are used for the interior wall construction. They are perforated with two 1-inch holes at the top and bottom to permit circulation of the internal atmosphere within the side wall. This partially insulates the exterior wall from interior heat and at the same time permits the entrance of humidity into the side wall cavity from the inside of the building. Wallboard and plaster may also be used on the interior, depending upon the subject under study.

The interior temperature is maintained at 70° F. through the use of thermostatically controlled heating units as shown in Figure 4 (a plaster wall appears on the left and galvanized iron sheets on the right). For purposes of close control the building is divided into three sections, each of which has separate heating and control units. In each section the temperature is kept uniform through the use of two fans which circulate the air in a rotary manner. A relative humidity of 60 per cent is maintained by a pan containing water which is placed on the floor of each section immediately beneath the heating unit and in line with one of the circulating fans. The pan is raised from the floor about an inch to ensure that the temperature of the water remains quite close to that of the room. The area of the pan controls the relative humidity. Daily records of the interior relative humidity and temperatures and the exterior maximum and minimum temperatures are maintained. It has been found that both temperature and humidity within the building vary but little, regardless of exterior conditions, provided that the exterior temperature does not rise above 60° F. or fall below 0° F.

The construction used provides a relatively humid atmosphere to the unpainted, interior portions of test panels, the exterior or painted portions of which are exposed to outside winter temperatures. Check tests have shown that on any one side of the building the conditions which cause failure are quite uniform.

In addition, sprays are placed in a portion of the wall of the building which permit the spraying of liquid water onto the unpainted interior surfaces of the panels. Exterior sprays are also provided. The use of this portion of the apparatus, however, does not come within the scope of the present paper.

The types of failure which have been obtained in this test building are practically identical with the types ordinarily obtained on houses. The similarity is evident in Figure 5. The pho-

tographs at the left show blistering on a house compared with blistering obtained in this test building; those at the right give a similar comparison for peeling.

Records

In addition to temperature and humidity, records are also kept of the moisture content of the wood immediately beneath the surface of the paint film. This is measured with one of the machines which is on the market for the purpose. The instrument measures approximately the highest moisture content existing between the needles, somewhat irrespective of the length of the path of current flow. The needles ordinarily used, however, have been shortened to a length of about $\frac{1}{8}$ inch. For certain purposes the moisture content of the wood on the back or interior sides of the panels is similarly measured through 6-inch portholes provided in the interior walls for this purpose (Figure 4). On account of the high moisture content at the time of failure and the necessity for only semiquantitative results, temperature corrections were not considered necessary.

The physical condition of the paint

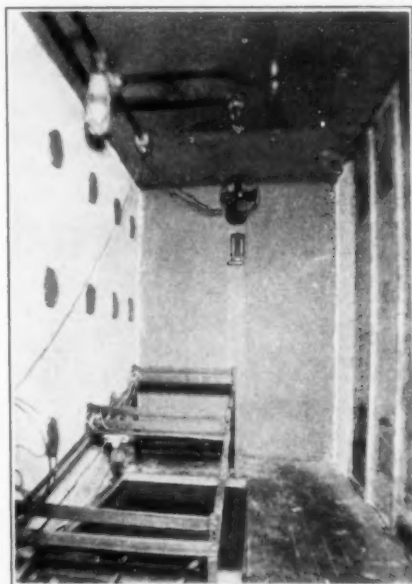


Figure 4. Interior of test house.

is recorded through direct observations. In order to make this inspection uniform, a series of photographic standards defining the type and extent of blistering or peeling is used. For purposes of simplification, how-

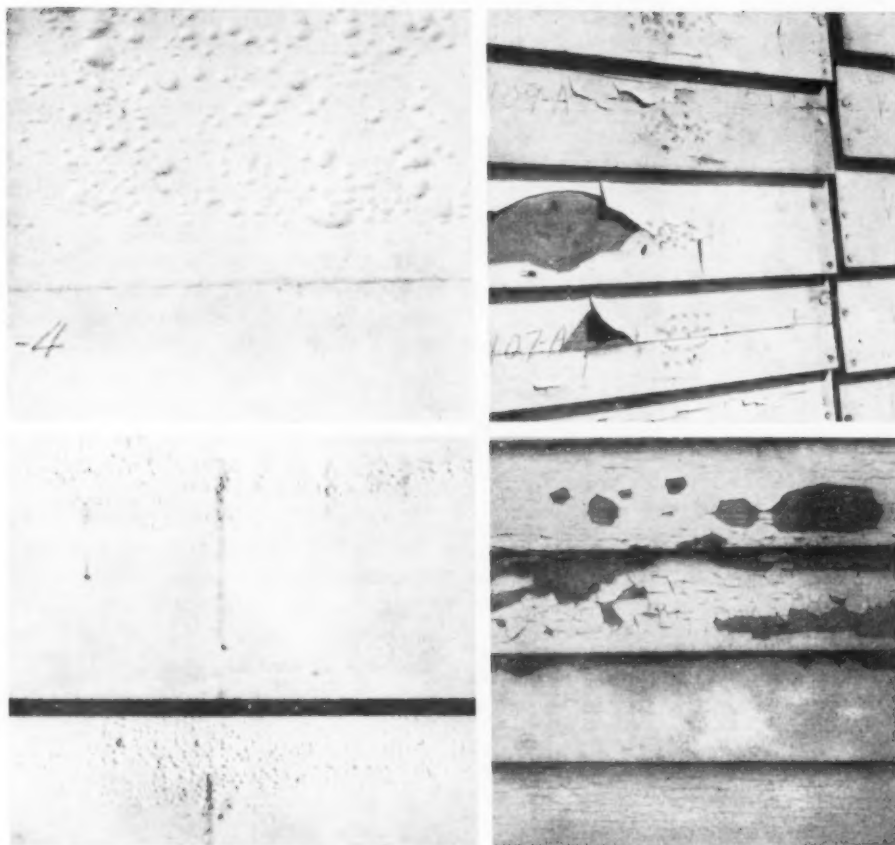


Figure 5. Blistering and peeling on test house (above) and on dwelling (below)

ever, only the extent of failure and not the type is included here.

Records are maintained in graphic form on record cards. A typical example is shown in Figure 6. The time coordinate records of the extent and type of paint failure are maintained, as well as the moisture content of the wood. In this study of structural details the moisture content of the wood serves as a check on the appearance of paint failure.

The data used for the photographs shown in the paper were taken from the best known paint and paste types on the market.

Effect of Structural Details

A survey of the problem of paint failure due to moisture makes it increasingly apparent that moisture peeling has become more prevalent during the last two decades than it was in earlier times. A number of changes in the details of construction and operation of houses have occurred which apparently have a considerable bearing on this increase in the moisture failure of house paint. These changes have been made with the ob-

jectives of decreasing fuel costs, improving living comforts, and decreasing fire hazards. The more important items which affect paint performance are as follows:

FIRE STOPS. The introduction of fire stops has decreased the circulation of air within the side walls, limiting it to one floor.

CENTRAL HEAT. The more general use of central heat with consequent lack of local removal of humidity with external air has had an adverse effect. This air was necessary to supply the drafts for stoves or fireplaces.

INCREASED OPERATING TEMPERATURES. An increase in the internal temperature increases the internal-external temperature differential and at the same time raises the absolute humidity of the interior air. Both of these favor an increase in blistering or moisture peeling.

INTRODUCTION OF HUMIDITY INTO HOUSES. The effect of the deliberate introduction of humidity is obvious.

TIGHTNESS OF CONSTRUCTION. The construction

has been greatly tightened to reduce heat losses in the winter and the entrance of heat in the summer, and to prevent the actual entrance of external air into the building at any point.

In addition to the structural details mentioned, careless workmanship has always been a factor in this problem of moisture peeling.

There are a number of important sources of artificial moisture which may cause trouble in addition to deliberate humidification—namely, building moisture resulting from poorly dried lumber, plaster, etc.; the use of open gas or oil heaters without external vents; vapor from hot water such as laundry tubs, bathrooms, food cooking, etc. Damp basements also frequently contribute to high water vapor pressure.

One of the most important sources of moisture which causes paint failure is that resulting from a warm, rainy spell followed by a sharp drop in temperature. The high humidity causes an accumulation of moisture in the air within the building. The sharp drop in temperature causes the moisture in the air to condense against the cold clapboard siding.

Effect of Tar Paper

It is ordinarily considered that much or all of this interior vapor can be prevented from reaching the exterior side walls through the use of a moisture barrier. The most common of these barriers is tar paper, which is customarily located between the sheathing and the siding.

The construction used in this test is very similar (Figure 7). The sheath-

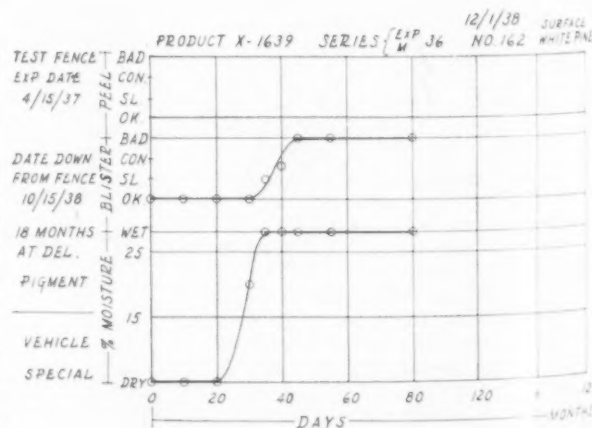


Figure 6. Moisture peeling. Con. = considerable; sl. = slight.

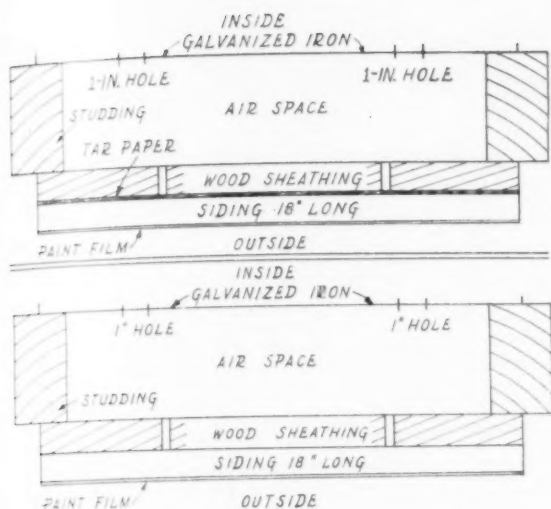


Figure 7. Construction used for tar paper test.

ing was attached to the studding, and after the tar paper was tacked on, the painted siding was nailed to the sheathing in the usual manner. A similar section without the tar paper was used as the control. The tar paper (a good grade, weighing 2 ounces per square foot) had a permeability which permitted the passage of 0.541 mg. of moisture per sq. cm. per hour under a vapor pressure differential of 0.93 inch of mercury.

The results of this test are shown in Figure 8. The weather during the early part of the test was comparatively mild. Forty days passed before

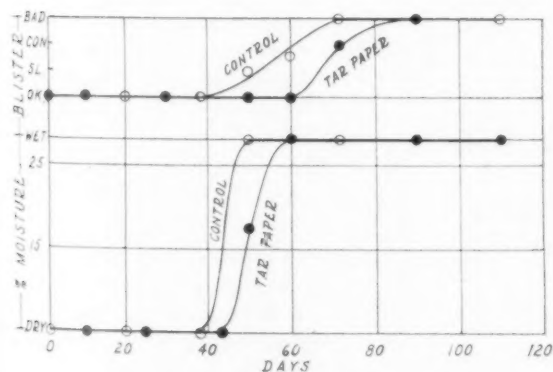


Figure 8. Effect of tar paper.

the control showed any increase in moisture, and the first blistering occurred on the fiftieth day. The tar paper exerted a slight retarding effect and the first blistering was recorded on the seventy-fourth day.

Further evidence is shown in Figure 9. These tests were run during the winter of 1938-39. The extent of blistering after 62 days is shown when

der these severe conditions, it is probable that a somewhat more favorable effect would be obtained under less severe conditions.

The effectiveness of tar paper in reducing or promoting trouble when the moisture is due to an external leak will depend, to a considerable extent, on the side of the tar paper down which the water will run. If it runs between the tar paper and the sheathing, the ordinary lapping of the tar paper may lead the moisture to the tar paper-siding interface. Several practical cases were recently observed where the type of construction in the houses was such that the external moisture leaks led the water directly to the tar paper-siding interface. In these cases moisture failure was greatly promoted by the presence of the tar paper because it retarded the evaporation of moisture into the side wall where it might conceivably have become dissipated by convection currents of air.

It has been suggested that the tar paper should have been placed between the lath and the studding — i. e., against the interior wall — rather than in the position shown, to permit a favorable

four different thicknesses of tar paper were used.

It is obvious that an excessive amount of tar paper is necessary to offer a material improvement under these conditions. Theoretically it is necessary to insert a barrier which possesses moisture impedance equal to or greater than that of the sum of the total paint systems applied to the house during its painting history.

Although the degree of improvement in this test was not great under



Figure 9. Effect of different thicknesses of tar paper.

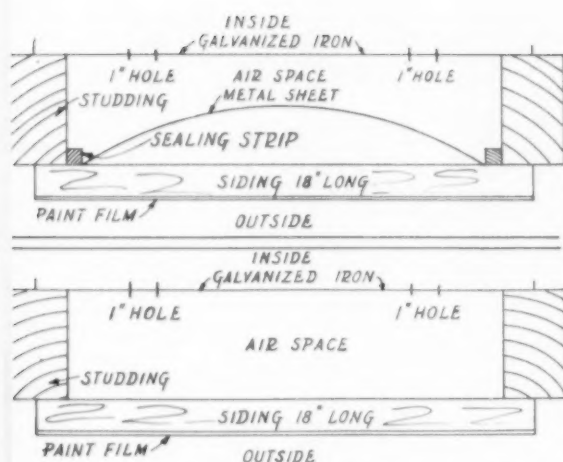


Figure 10. Impermeable moisture barrier.

effect against internal moisture vapor.

Wide Variations in Color Preference for Cars Shown Thruout U. S.

A recent study of color preferences in motor cars discloses wide variations in the likes and dislikes throughout the country.

The only finish the entire country agrees on is black, which is seldom nosed out of first place. Its lead may change from 30% over any other color in one section of the country to 5 or 10% in another, yet it is usually tops as a motor car finish. In 1939, however, an exception to the rule occurred on the Pacific Coast where dark gun-barrel grey superseded black in first place.

On the Pacific Coast are recorded the most violent changes in color preferences. There, people are so insistent upon having their cars finished in light colors that many manufacturers do not even attempt to sell them the regular color line-up, but substitute pale, light nuances for the darker shades.

In spite of their overwhelming preference for light shades, the far West shows the most even distribution of color preferences of any section of the country. While usually the leader, black rarely rates a higher sales percentage than twenty, few colors sold on the Coast average less than 5%.

In 1939, almost 25% of the cars sold on the West Coast were finished in two types of grey finish; dark blue-steel grey and pale, frosty, blue-grey shades which have little appeal for the rest of the country. To date this

Impermeable Moisture Barrier

Since the tar paper with its limited impedance has an appreciable delaying effect, it is obvious that the use of a highly impermeable layer might be completely effective in preventing moisture failure due to condensation causes. Accordingly a type of material which consists primarily of a thin layer of metal was used as a complete seal. It was carefully tacked to the floor plate and ceiling plate (fire stop) and to the studding; thin strips of wood were used to ensure close contact. Figure 10 indicates the setup and Figure 11 illustrates the results of the test.

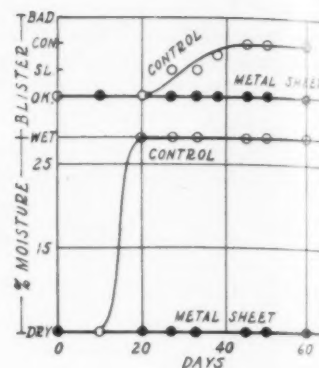


Figure 11. Results of metal sheet test.

(Concluded in May issue)

black. New England definitely turns thumbs down on light colors and brown.

Next to the Southwest, the Northwest buys fewest black cars. Dark grey has been, and still is, the prime favorite, with dark green a close third. Light grey is fairly well received, and maroon is growing in popularity.

The Middle Western and the Prairie states, after a long period of selecting dark grey as second choice color, have replaced it with maroon, something that has never happened before. This is peculiar to these regions, for in spite of maroon's growing popularity the country over, nowhere else in the United States has it succeeded in rising to better than fourth place.

Within these sections there are sharp color preferences. Richmond, Va., buys a higher percentage of black cars than any other city, while Los Angeles buys the smallest. Syracuse, N. Y., likes dark greys, Memphis refuses them. Indianapolis likes dark green, Omaha dislikes it.

St. Louis chooses more cars finished in maroon than any other district, yet New York dislikes that color. Pale grey beige is more popular in Los Angeles than any other city. Omaha is one of the few places where maple-leaf browns sell well. Dark blues sell best in Charlotte, N. C., while strangely, conservative Philadelphia does not care for dark blue. El Paso buys the highest percentage of pale, creamy grey of any city in the country. Metropolitan New York likes light colors almost as much as the West Coast.

—Courtesy E. I. DuPont de Nemours & Co., Wilmington, Delaware.

year, color preferences are entirely different. Almost 40% of the cars now being sold in California are finished in creamy beiges and light, but brilliant, greens, little interest being shown in grey.

Another extreme change in color preferences was recorded in the deep South this year. In 1939, although this section bought almost fifty per cent of its cars finished in black, dark blue was a strong second choice, while the balance of the country rated blue no better than fifth or sixth choice. This year, the same region has relegated blue to fourth place. It is still choosing its colors in contradiction to the rest of the country, however, for its second choice color is now dark green—a situation that, again, exists nowhere else.

A semi-tropical climate does not seem to determine color choice, for the deep South has a climate with much sun and sub-tropical foliage, yet more black cars are sold there than anywhere else. The only exception is Florida, where the demand for light colors is very great.

The middle Atlantic states, particularly the "Tidewater Section" and the "Dutch Country" of Pennsylvania, buy so many cars finished in black, it is difficult for any color to make much of a showing. This region does evince some enthusiasm, however, for dark grey and dark green.

New England is second to the middle Atlantic states in preference for

Solvents in Industry

Ethyl Acetate

(Acetic Ether, Acetic Ester, Vinegar Naphtha)

Physical Properties

Ethyl acetate is a clear, colorless and flammable organic liquid having a characteristic fruity odor and, when diluted, a pleasant taste. It is a member of the ester group of organic compounds and has the molecular formula $\text{CH}_3\text{COOC}_2\text{H}_5$. Its molecular weight is 88.064.

Ethyl acetate is miscible with most organic liquids, including alcohols, ketones, esters and the various hydrocarbons, and will tolerate relatively large quantities of diluents used in lacquers. It produces solutions of low viscosity of nitro and acetyl cellulose and cellulose ethers and is considered one of the best of the faster evaporating solvents for nitrocellulose. The solvent power of ethyl acetate for cellulose derivatives is enhanced by the addition of small amounts of alcohol. Ethyl acetate is a solvent for a large number of fats, waxes, oils, gums and resins, both synthetic and natural.

Pure ethyl acetate is soluble in water up to 7.9 per cent by weight at 20°C. It dissolves up to 3.0 per cent by weight of water but forms with it a constant boiling mixture, containing 93.0 per cent by weight of ethyl acetate, boiling at 70.4°C.

The evaporation rate of ethyl acetate, referred to butanol as having a value of 100, is approximately 1150, or about twelve times as fast.

Ethyl acetate in the pure form is listed as having a specific gravity of 0.901 at 20°/4°C. (7.52 pounds per gallon at 20°C.). Its boiling point at 760 mm. mercury pressure is 77.1°C. and its melting point is—82.4°C. At 20°C. its vapor pressure is 73 mm. of mercury. The flash point of ethyl acetate (closed cup) is 31°F.

Chemical Properties

In addition to the usual reactions of esters, ethyl acetate enters into a number of special reactions as a reagent, as a starting point material and in at least one case as a catalyst.

Acetamide, a white solid of somewhat disagreeable odor which has been suggested as an anti-acid stabilizing plasticizer for cellulose esters, may be prepared from ethyl acetate.

Methyldiethylcarbinol may be obtained from ethyl acetate and an excess of ethyl magnesium bromide.

Ethyl acetate and acetone condense to give acetylacetone.

In the reaction of sodium amalgam with primary bromides and iodides to form mercury dialkyls, high boiling and very toxic

liquids, ethyl acetate functions as a catalyst.

Ethyl acetoacetate is prepared by bringing two molecules of ethyl acetate into reaction by metallic sodium in the presence of a trace of alcohol.

Physiological Properties

Ethyl acetate is a carminative, stimulant and antispasmodic. Its chief medicinal use is in combination with water for inhalation in cases of laryngeal catarrh. In veterinary medicine it is employed as a stimulant and antispasmodic in doses like those of ether.

The local irritative effects of ethyl acetate are said to be about the same as methyl acetate and somewhat less than butyl acetate and amyl acetate. In general, ethyl acetate is considered less toxic than acetone for industrial use. Chronic effects appear to be limited to irritation of the mucous membranes and a tendency to eczema. High concentrations have a narcotic effect.

Manufacture

Commercial ethyl acetate is made from 10 per cent acetic acid and 50 per cent alcohol by a process of distillation. A mixture of ethyl acetate, ethyl alcohol and water distills first. On dilution with water, this mix-

ture forms two layers, one of nearly pure ethyl acetate and the other of dilute alcohol. The ethyl acetate is removed, the ethyl alcohol is returned to the process and the water is discarded.

Another commercial process for the production of ethyl acetate uses acetaldehyde and catalysts such as aluminum ethylate with aluminum and mercury chlorides.

Ethyl acetate may also be obtained by passing acetic acid and ethyl alcohol over a heated silica gel catalyst and by the dehydrogenation of ethyl alcohol.

Uses

Because of its many valuable characteristics and properties, ethyl acetate finds wide and varied application in industry and science. In combination with other solvents and diluents it is used extensively in the formulation of thinners, lacquers, dopes, enamels and other coating materials. It is used in the manufacture of photographic film, plastics, polishes, artificial leather, linoleum, cements, coated paper, smokeless powder and cleaning compounds. It is employed in organic synthesis as the starting point for many compounds; in extracting and purifying processes; and in the preparation of flavorings, dyes, drugs, paint removers, perfumes and embalming fluids. Certain denatured alcohol formulae call for its use as a denaturant.

Ethyl acetate is obtainable in a number of grades. When undenatured it is sold for food, pharmaceutical, scientific, export or denaturing purposes only. Denatured ethyl acetate is available for manufacturing needs.

Standard Specifications for Ethyl Acetate (85 to 88 Per Cent Grade)

A.S.T.M. Designation: D302 - 33

Issued as tentative, 1929; Adopted in amended form, 1933.

Properties

1. Ethyl acetate (85 to 88 per cent grade) shall conform to the following requirements:

Specific gravity	0.883 to 0.888
Color	water white
Distillation range: (a)	
Below 70°C.	none
Below 72°C.	not more than 10 per cent
Above 80°C.	none
Non-volatile matter	not more than 0.005g. per 100 ml.
Odor	mild, non-residual
Water	miscible without turbidity with 10 volumes of 60° Baume gasoline at 20°C.
Acidity (free acid as acetic acid)	not more than 0.02 per cent, equivalent to 0.19 mg. KOH per gram of sample
Ester value	85 to 88 per cent by weight

Methods of Testing

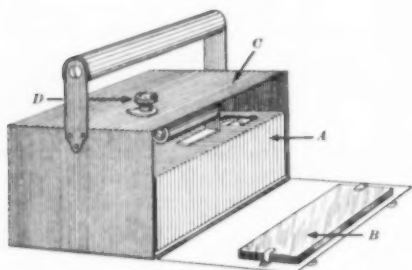
2. The sampling and methods of testing shall be conducted in accordance with the Standard Methods of Sampling and Testing Lacquer Solvents and Diluents (A.S.T.M. Designation: D 268) of the American Society for Testing Materials.
- (a) The thermometer used for the distillation test shall conform to the requirements of the Standard Specifications for A.S.T.M. Partial-Immersion Thermometer of General Use, —20 to +150°C., 0 to 300°F. (A.S.T.M. Designation. D 182) of the American Society for Testing Materials.

NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

Portable Glossmeter

A portable glossmeter, designed primarily to test samples for compliance with specifications for original gloss, and to measure changes in gloss of surfaces resulting from weathering, wear, abrasion and other treatments, has been announced by the Henry A. Gardner Laboratory, Inc., 1500 Rhode Island Ave., N.W., Washington, D.C.



Portable Glossmeter

The apparatus consists of a light-tight housing, built-in flashlight lamp with reflector and a General Electric photoelectric illumination meter. Direct readings of gloss are said to be obtained in two seconds on the scale of the meter. A restricted aperture is provided for the gloss opening, so that the diffuse reflectance correction for gloss readings is a minimum.

This glossmeter should have a wide usage in determining the specular gloss of industrial finishes, such as refrigerator enamels, automobile finishes, railroad finishes of varnishes and lacquers of all kinds, and of pigmented interior white coatings for factories. The readings are almost independent of the color of the coating. Where sharpness-of-image gloss is the important factor, the gloss comparator is used.

New Drying Lamps

Four new infrared drying lamps in 250- to 1000-watt sizes, designed for industrial or commercial drying and heating jobs, have been announced by the Westinghouse Lamp Division, Bloomfield, N. J.



Four new infra-red drying lamps.

The new line includes a 250-watt lamp with pear-shaped clear glass bulb and medium screw base; a 250-watt reflector drying lamp in the familiar inside-frosted R-40 bulb, also with medium screw base; and 500- and 1000-watt lamps in clear glass, globular bulbs, both with medium bipost bases, for heavy duty work. All are designed for use on 105- to 120-volt circuits. With the exception of the reflector drying lamp, all should be used in conjunction with especially designed aluminum or gold-plated reflectors.

The reflector drying lamp is a self-con-

tained lamp and reflector, incorporating a metallic reflecting coating which is applied to the inside of the specially shaped blown glass bulb, then hermetically sealed in the bulb, and thus protected from dust, dirt, moisture and deterioration.

Rated laboratory life of all the new drying lamps is in excess of 5,000 hours, hence they are expected to prove economical and advantageous for many drying and heating operations including the drying of enamels, lacquers and paints, photographic negatives and prints, blueprints, photostats and numerous other materials.

Water Wash Spray Booth

Faraday Engineering Co., 56 Clearway St., Back Bay, Boston, Mass., have designed and marketed a new water-wash spray booth called the "Hydro-Clone" spray booth.

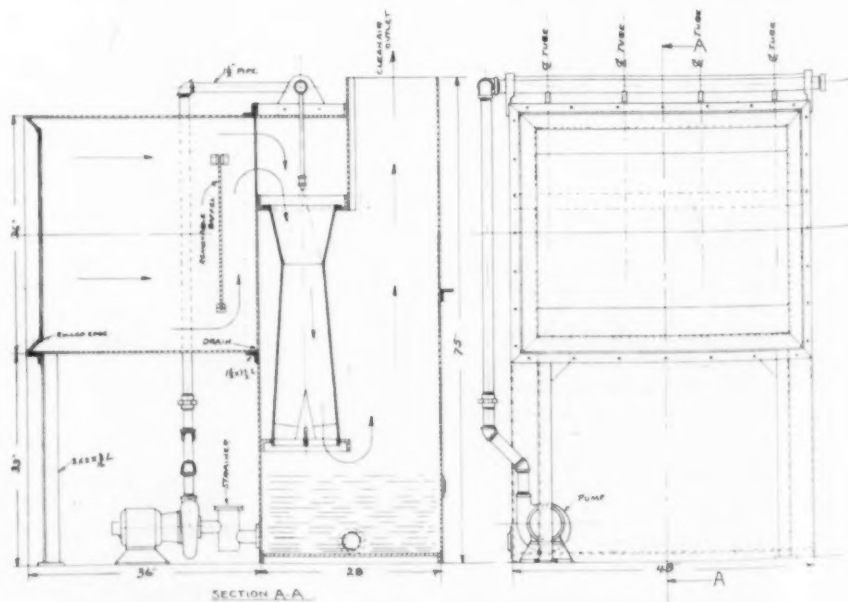
In this water-wash booth, the air flow through the spray hood is induced by water jets or nozzles, which spray downward into venturi tubes located in the water chamber. The water and fumes together with the surplus material that is sprayed, impinge upon the vane cones at the bottom of the venturi tubes. This impinging action thoroughly mixes the water with the fumes and solids so that they are completely suppressed in the water in the bottom of the tank. The water is re-circulated through the spray nozzles by the pump and the solids are removed by filtering.

The jet action of the sprays induces a powerful suction of air at the face of the spray hood which would lead one unacquainted with the construction of the spray booth, to believe that a fan was the motivating force. However, no fan is required.

The booth is said to completely eliminate fire hazard and is really a fire extinguisher in itself.

Each tube will handle 600 C.F.M. of air with only 50 pounds pressure on the spray nozzles. This produces more than the required 100-200 feet per minute air velocity at the face of the hood.

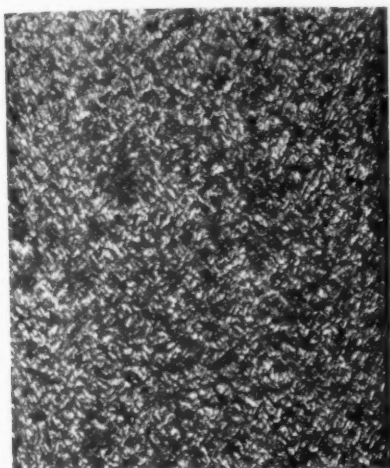
Hydro-Clone spray booths are made in any size and to handle any volume of air, and can be supplied with separate dewatering tanks to separate the solids from the water.



Sectional drawing of new water-wash spray booth.

New Industrial Finish

Incorporating a number of features said to be much in demand for finishing metal surfaces, the Tousey Varnish Company, 520 West 25th Street, Chicago, Illinois, has announced a new industrial finish called No. 1 Chromelume, a ready mixed aluminum. These features are: (1) an extreme brilliance, (2) will air dry in 15 minutes, (3) will not rub off after aging, (4) covers approximately 2,000 sq. ft. of surface per gallon, (5) will not settle or pack in container, (6) can be dipped, sprayed, or flow coated, (7) retains its elasticity, and (8) keeps its remarkable luster and will not powder.



Mixed aluminum finish.

No. 1 Chromelume has proved successful as a finish for a wide number of products, such as office equipment, cabinets, machinery, instruments, and metal vaults. Other Chromelumes have been developed for outside durability, water immersion, and heat resistance.

Flock Gun

Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill., have marketed a flock gun designed for rapid application of flock when supplied from a flock pressure tank or mechanical feed hopper.



Spray gun for spraying flock.

The body of the gun is of forged brass and nickel plated. It has an aluminum alloy pistol grip handle with an easy operating trigger. When the double-action trigger is fully drawn back, a wide continuous stream of flock is delivered. A slight pull on the trigger releases a blast of clean air for blow-

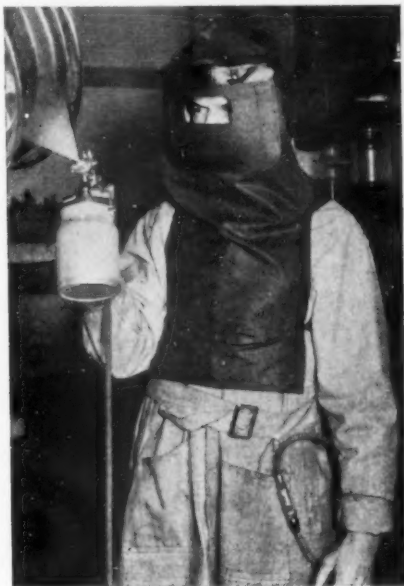
ing off the excess flock. The gun is light in weight, and is claimed not to clog.

The gun can be equipped with specially designed nozzles for unusual applications.

Spraying Hood

A new spraying hood has been offered by Jackson Electrode Holder Co., Detroit, Mich., for workmen engaged in paint spray operations.

The hood is of tailored, black, rubberized fabric, with a comfortable headgear equipped with extra wide sweatbands.



New paint spraying hood.

Air supply from the plant air line is conducted through a flexible hose attached to the operator's belt, to a light metal tube conforming to but not touching his brow. Twenty-four vents allow fresh air to issue in a cascade over the operator's face and out through the clear opening in front of his eyes. This air flow sweeps fumes and dust away from him. The opening is cut in a black fiber unit which is easily removed from the hood and replaced by a similar unit having a standard $6\frac{1}{2} \times 9\frac{3}{4}$ inches clear Plastacele window. This assembly is used when protection from dust is desired. The whole rig is light and comfortable and a quick acting fitting makes attachment of air supply hose to plant airline easy.

Abrasion Resisting Enamel

Baer Bros., 438-448 West 37th Street, New York, N. Y., have announced their "Baer-tex", a new abrasion-resisting enamel, which is now available not only in battleship gray, but also in 21 other colors. A color card will be furnished upon request.

This high gloss enamel coating is recommended for use on concrete floors and on any interior surface wherever a glossy, long wearing overnight-drying finish is desired.

It is also intended for a hard-wearing gloss wall paint inasmuch as it will stand many scrubblings and cleanings. The synthetic enamel it is said has an average covering power of 600 to 700 sq. ft. per gallon.

Manufacturer's Literature

Finishes. The Ferro Enamel Corp., Cleveland, Ohio, have recently published a booklet entitled "The Finish on Your Product", which discusses the comparative performances of various chemical finishes; color retention, gloss, corrosion or weather resistance, resistance to chemicals and physical characteristics of porcelain enamel. Air-drying lacquers and paints, baking enamels, alloys, galvanizing, plating and chemical treatments are discussed.

Hammered Finishes. Bulletin No. 9-HK of the Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y., describes blue, green, brown and other color combinations to be obtained in the company's Vitra-Carlite Hammerkraft finish, which is a smooth finish with a hammered effect, and which hides imperfections in the metal. The finish is produced in two spray operations and one baking.

Metal Cleaning. "Metal Cleaning Hints" is a bulletin of the Neilson Chemical Co., 6564 Benson St., Detroit, Mich., describing the use of "Metalprep" for treating of metal surfaces previous to organic finishing. The bulletin is written for paint salesmen, painters, paint foremen and service men.

Ovens. The Gehnrich Corp., Skillman Ave. & 35th St., Long Island City, N. Y., have just published a well illustrated 32-page catalog No. 107. The catalog contains illustrations of ovens and dryers for various industrial heating purposes, such as for lacquering, enameling, japanning, core baking and metal heat treatment.

Splatter Finish. Bulletin No. 21-S of the Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y., describes the company's Vitra-Carlite Splatter Finishes which are rich basic finishes with speckled effects. The coatings are high gloss, synthetic materials for metal and wood and other porous surfaces which have been sealed.

Spray Painting Literature. The DeVilbiss Co., Toledo, Ohio, have just published a handbook entitled, "A B C of Spray Painting Equipment," in which every type of spray equipment is described and the functions explained in five parts of the book. The subjects treated are the paint spray gun, its troubles, remedies and accessories; material containers; hose and hose connections; air transformers and condensers and air compressing outfits.

The material is presented in question and answer form, and frequent illustrations and diagrams are used.

Single copies may be obtained free or arrangements made for procuring copies in bulk, by writing to the company.

A. C. Horn Company, Long Island City, N. Y., is extending its Wrinkle Finish activities to include its plants in Boston, Chicago, Dallas, Houston, San Antonio, New Orleans and San Francisco.

EGYPTIAN *high-bake* N.F.R.

A tough, mar-proof, chemically resistant synthetic finish for all types of metal products . . . Extremely durable. Increases resistance to abrasion and other forms of wear



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ONE COAT DIRECTLY ON SMOOTH METALS. NO PRIMING COAT NECESSARY.

Ask for further information

THE EGYPTIAN LACQUER MANUFACTURING CO.

ROCKEFELLER CENTER
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EGYPTIAN FINISHES

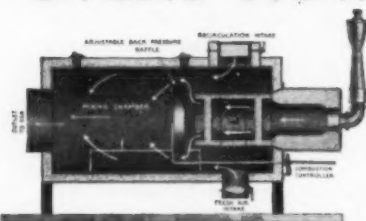
• In addition to High-Bake N. F. R. we also make a complete line of clear and pigmented lacquers for standard and individual requirements. These are furnished for spray dip or brush application . . . Air-dry and bake.

Ask for details

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REVAMP YOUR OVENS NOW!

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Despatch DG 250 Air Heater, 250,000 BTU capacity
(Patent Pending)

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Write today for new bulletin No. 72 illustrating the Despatch "Controlled Combustion" Air Heater and how it may be applied to your oven!

DESPATCH OVEN COMPANY MINNEAPOLIS MINNESOTA

New Book

Toxicity of Industrial Organic Solvents. Compiled by Ethel Browning under the direction of the Committee on the Toxicity of Industrial Solvents. Published by Chemical Publishing Co., New York. Size 4" x 7"; 382 pages. Price \$3.50.

Many volatile substances now used in industry may have injurious effects upon the health of workers using them. The number of such substances is increasing daily. As adverse effects upon the health of workers may also occur after a long period of exposure to dilute concentration of substances which are poisonous in high concentrations, there is need for research in order to find out the actual toxic effects of each substance under any conditions likely to be met in industry. As a first step, it has been necessary to collect the information already available. This has now been done for the Industrial Health Research Board by Dr. Ethel Browning. The chapters review the following main groups of chemicals:

The Hydrocarbon Group; The Chloro Compounds; The Alcohols; The Esters; The Cyclohexane Derivatives; The Ketones; The Glycol Group; Miscellaneous Including Carbon Bisulphide, Pyridine and Ethyl Ether.

In consideration of each solvent, properties, manufacture and uses are described. This is followed by a presentation of available data on the effects of solvents in industry as recorded in the various literature. Acute and chronic effects of the solvents are considered and physiological data are presented.

This book should be carefully studied by all those who use solvents, or for people who may be exposed to low concentrations for a long time or for short exposures to large concentrations.

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